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BULLETIN No. 7

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF ORNITHOLOGY AND MAMMALOGY

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PRELIMINARY REPORT ON THE FOOD OF WOODPECKERS

BY

F. E. L. BEAL
Assistant Ornithologist

Smithsonian Institution
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National Zoological Park
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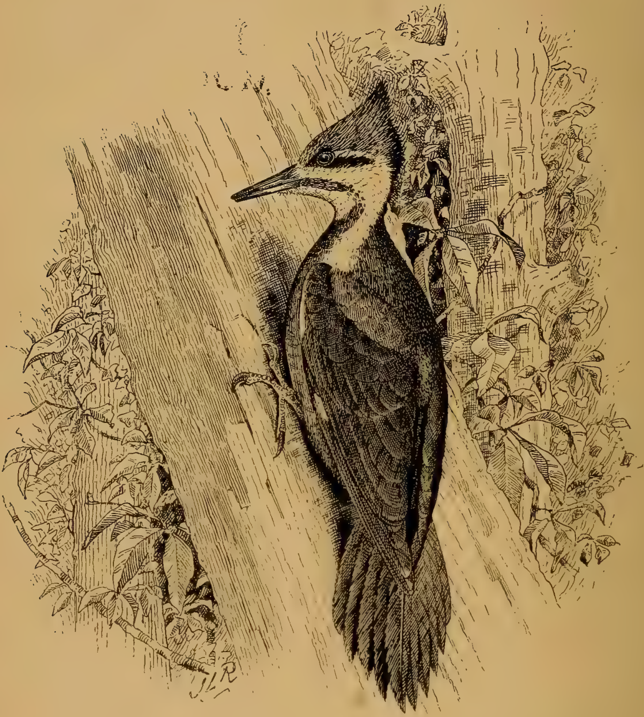
THE TONGUES OF WOODPECKERS

BY

F. A. LUCAS
Curator, Department Comparative Anatomy
U. S. National Museum

WASHINGTON
GOVERNMENT PRINTING OFFICE
1895



PILEATED WOODPECKER OR LOGCOCK (*Ceophlœus pileatus*).

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
Washington, D. C., May 15, 1895.

SIR: I have the honor to transmit, as Bulletin No. 7 of this division, a preliminary report on the Food of Woodpeckers, by Prof. F. E. L. Beal, Assistant Ornithologist. The report is accompanied by a short article on the 'Tongues of Woodpeckers,' prepared at my request by Mr. F. A. Lucas, Curator of the Department of Comparative Anatomy, United States National Museum.

Respectfully,

C. HART MERRIAM,
Chief of Division of Ornithology and Mammalogy.

HON. J. STERLING MORTON,
Secretary of Agriculture.

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PRELIMINARY REPORT ON THE FOOD OF WOODPECKERS.

By F. E. L. Beal, *Assistant Ornithologist.*

GENERAL REMARKS.

With the possible exception of the crow, no birds are subject to more adverse criticism than woodpeckers. Usually no attempt is made to discriminate between the numerous species, and little account is taken of the good they do in destroying injurious insects. The name 'Sapsucker' has been applied to two or three of the smaller kinds, in the belief that they subsist to a great extent upon the juices of trees, obtained from the small holes they make in the bark. There can be little doubt that one species, the Yellow-bellied Woodpecker (*Sphyrapicus varius*), does live to a considerable extent upon this sap. Observation does not show that other species have the same habit, but it is a difficult point to decide by dissection, as fluid contents disappear quickly from the stomach.

Many observers have testified to the good work these birds do in destroying insects, while others have spoken of harm done to fruit or grain. Both are correct within certain limits.

Field observation on the food habits of birds is attended with so many difficulties as to render it a very unreliable source from which to draw general conclusions. The most conscientious and careful person is often deceived, not only as to the quantity of a particular kind of food eaten by a bird, but as to the fact that it is eaten at all. The further difficulty of keeping a number of birds, or even a single one, under constant observation makes an estimate of relative proportions of different kinds of food impossible. When much mischief is done the fact is apparent, but there is no way to find out how much good is done during the same time. For these reasons it often happens that reports on food habits, based on observations of wild birds, not only conflict with each other but also disagree with the results obtained from stomach examinations. This last method must be taken as the court of final appeal, and it is evident that a collection of stomachs covering every month in the year, and as nearly as may be all points of the birds' range, becomes more and more trustworthy as it increases in size; in other words, the more stomachs examined the nearer correct will be the result as to the birds' annual diet.

The present paper is merely a preliminary report, based on the examination of 679 stomachs of Woodpeckers, and representing only 7 species—all from the eastern United States. These species are the Downy Woodpecker (*Dryobates pubescens*), the Hairy Woodpecker (*D. villosus*), the Flicker or Golden winged Woodpecker (*Colaptes auratus*), the Red-headed Woodpecker (*Melanerpes erythrocephalus*), the Red-bellied Woodpecker (*Melanerpes carolinus*), the Yellow-bellied Woodpecker (*Sphyrapicus varius*), and the Great Pileated Woodpecker (*Ceophlœus pileatus*). Examination of their stomachs shows that the percentage of animal food (consisting almost entirely of insects) is greatest in the Downy, and grades down through the Hairy, Flicker, Pileated, Redhead, and Yellow-bellied to the Red-bellied, which takes the smallest quantity of insects. Prof. Samuel Aughey stated that all of these species except the Pileated (which was not present) fed upon locusts or grasshoppers during the devastating incursions of these insects in Nebraska. The vegetable matter, of course, stands in inverse order. The greatest quantity of mineral matter (sand) is taken by the Flicker, somewhat less by the Redhead, very little by the Downy and Hairy, and none at all by the Yellow-bellied and Pileated.

The stomachs of all of the 7 species except the Redhead and Red-bellied contained the substance designated as 'cambium' in the accompanying list of vegetable food. This is the layer of mucilaginous material lying just inside of the bark of trees, and from which both bark and wood are formed. It is supposed by many to be the main object sought by woodpeckers. Except in the case of a single species the stomach examination does not bear out this view, since cambium, if present at all, was in such small quantities as to be of no practical importance. The Yellow-bellied Woodpecker, however, is evidently fond of this substance, for in the stomachs examined it formed 23 percent of the whole food of the year. It was found in 37 stomachs, most of which were taken in April and October. Of 18 stomachs collected in April, 16 contained cambium, and one of the remaining contained no vegetable food whatever. Moreover, as the true cambium is a soft and easily digested substance it is probable that what is usually found in the stomachs is only the outer and harder part, which therefore represents a much larger quantity. The extent of the injury done by destroying cambium must depend on the quantity taken from individual trees. It is well known that woodpeckers sometimes do serious harm by removing the outer bark from large areas on the trunks of fruit trees. The rings of punctures often seen around the trunks of apple trees are certainly the work of the Sapsucker, though sometimes attributed to the Downy and Hairy Woodpeckers. But the bird is not sufficiently numerous in most parts of the country to do much damage.

It is a difficult task to summarize the results of the investigations herein detailed, more especially if an attempt is made to decide as to the comparative merits or demerits of each particular species. The stomach examinations do not always corroborate the testimony received from observers, and many no doubt will be inclined to think they have seen more harm done by some members of this family of birds than is shown by the data here published. If birds are seen feeding repeatedly on a certain kind of food the inference is that they are particularly fond of it, but the truth may be that they are eating it because they can find nothing they like better, and that a collection of their stomachs from many localities would show only a small percentage of this particular food.

In reviewing the results of these investigations and comparing one species with another, without losing sight of the fact that comparative good is not necessarily positive good, it appears that of 7 species considered the Downy Woodpecker is the most beneficial. This is due in part to the great number of insects it eats and in part to the nature of its vegetable food, which is of little value to man. Three-fourths of its food consists of insects, and few of these are useful kinds. Of grain, it eats practically none. The greatest sin we can lay at its door is the dissemination of poison ivy.

The Hairy Woodpecker probably ranks next to the Downy in point of usefulness. It eats fewer ants, but a relatively larger percentage of beetles and caterpillars. Its grain-eating record is trifling; 2 stomachs taken in September and October contained corn. For fruit, it seeks the forests and swamps, where it finds wild cherries, grapes, and the berries of dogwood and Virginia creeper. It eats fewer seeds of the poison ivy and poison sumac than the Downy.

The Flicker eats a smaller percentage of insects than either the Downy or the Hairy Woodpecker, but if eating ants is to be considered a virtue, as we have endeavored to show, then surely this bird must be exalted, for three-fourths of all the insects it eats, comprising nearly half of its whole food, are ants. It is accused of eating corn; how little its stomach yields is shown on another page. Fruit constitutes about one-fourth of its whole fare, but the bird depends on nature and not on man to furnish the supply.

Judged by the results of the stomach examinations of the Downy and Hairy Woodpecker and Flicker it would be hard to find three other species of our common birds with fewer harmful qualities. Not one of the trio shows a questionable trait, and they should be protected and encouraged in every possible way. Fortunately, only one, the Flicker, is liable to destruction, and for this bird each farmer and landowner should pass a protective law of his own.

The Redhead makes the best showing of the seven species in the kinds of insects eaten. It consumes fewer ants and more beetles than any of the others, in this respect standing at the head, and it has a pronounced taste for beetles of very large size. Unfortunately, however, its fondness for predaceous beetles must be reckoned against it. It also leads in the consumption of grasshoppers; these and beetles together forming 36 percent of its whole food. The stomachs yielded enough corn to show that it has a taste for that grain, though not enough to indicate that any material damage is done. It eats largely of wild fruit, and also partakes rather freely of cultivated varieties, showing some preference for the larger ones, such as apples. In certain localities, particularly in winter, it feeds extensively on beechnuts. No charge can be brought against it on the score of injuring trees by pecking.

The Red-bellied Woodpecker is more of a vegetarian than any of the others. In certain localities in Florida it does some damage to oranges, but the habit is not general. On the other hand, it eats quantities of ants and beetles.

The Yellow-bellied Woodpecker seems to show only one questionable trait, that of a fondness for the sap and inner bark of trees. Both field observations and the contents of the stomachs prove this charge against it, but it is not probable that forest trees are extensively injured, or that they ever will be, for aside from the fact that the bark of many trees would be unpalatable an immense number of birds would be required to do serious damage. But with fruit trees the case is different. Their number is limited, and there are no superfluous ones as in the forest. In localities where the bird is abundant considerable harm may be done to apple trees, which appear to be pleasing to its taste.

The Pileated Woodpecker is more exclusively a forest bird than any of the others, and its food consists of such elements as the woods afford, particularly the larvæ of wood-boring beetles, and wild fruits. The species is emphatically a conservator of the forests.

In describing the stomach contents of the different woodpeckers a quantity of material is classed under the term 'rubbish.' The great bulk of this stuff is rotten wood and bark, picked up in digging for insects in decayed timber, and apparently swallowed accidentally with the food. If the 6 woodpeckers which had eaten rotten wood are compared with respect to the quantity of this material contained in the stomachs it is found that the Hairy Woodpecker stands at the head with 8 percent, the Downy next with 5, the Flicker with 3, the Redhead and Yellow-bellied with 1 percent each, and the Pileated with only a trace. From this it appears that the Hairy Woodpecker is preeminently a *woodpecker*, while the Redhead and Yellow-belly do much less of this kind of work. The difference in habit is obvious to the most casual observer. The Redhead is ordinarily seen upon a fence post or telegraph pole hunting for insects that alight on these exposed surfaces, and watching for others that fly near enough to be captured in mid-air. Unlike other woodpeckers, he is seldom seen digging at a rotten branch except in spring, when he prepares a home for the family he intends to rear. The Yellow-bellied, as will be shown presently, does much wood (or bark) pecking, but of another kind.

The following tables show the food percentages of the stomachs examined:

Percentages of food of 7 species of woodpeckers.

Name of species.	No. of stomachs examined.	Percentage of stomach contents.			Percentage of different insects.						
		Animal.	Vegetable.	Mineral.	Hymenoptera (ants).	Coleoptera (beetles).	Lepidoptera (caterpillars).	Orthoptera (grasshoppers).	Hemiptera (bugs, plant lice).	Diptera (flies).	Spiders and myriapods.
Downy Woodpecker (*Dryobates pubescens*)	140	74	25	1	23	24	16	3	4	1	3
Hairy Woodpecker (*Dryobates villosus*)	82	68	31	1	17	24	21	Trace.	2	....	4
Flicker (*Colaptes auratus*)	230	56	39	5	43	10	1	1	Trace.	Trace.	1
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	101	50	47	3	11	31	1	5	1	....	1
Red-bellied Woodpecker (*Melanerpes carolinus*)	22	26	74	Trace.	11	10	4	Trace.	Trace.	....	Trace.
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	81	50	50	....	36	5	2	1	1	3	2
Pileated Woodpecker (*Ceophlœus pileatus*)	23	51	49	....	30	15	2	Trace.	4	Trace.	Trace.

Relative proportions of larval and adult beetles (Coleoptera) in stomachs of 7 species of woodpeckers.

Name of species.	Number of stomachs examined.	Number containing adult Coleoptera.	Number containing larval Coleoptera.	Percentage of whole number.		Percentage of stomach contents.	
				Adult.	Larvæ.	Adult.	Larvæ.
Downy Woodpecker (*Dryobates pubescens*)	140	50	60	38	43	11	13
Hairy Woodpecker (*Dryobates villosus*)	82	27	46	33	56	6	18
Flicker (*Colaptes auratus*)	230	67	18	25	8	8	2
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	101	83	....	82	....	31	....
Red-bellied Woodpecker (*Melanerpes carolinus*)	22	6	4	27	18	7	3
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	81	15	1	19	1	5	Trace.
Pileated Woodpecker (*Ceophlœus pileatus*)	23	4	12	17	52	2	1

DOWNY WOODPECKER.

(*Dryobates pubescens.*)

This little woodpecker is the smallest, not only of the 7 species under consideration, but of all those inhabiting the United States. He is also one of the most familiar, being no stranger to the shade trees about houses and parks, while his fondness for orchards is well known. He is so quiet and unobtrusive that the first notice one has of his presence may be a gentle tapping or scratching on the limb of a tree within two or three yards of one's head, where our diminutive friend has discovered a decayed spot inhabited by wood-boring larvæ or a colony of ants.

One hundred and forty stomachs of the Downy Woodpecker have been examined. They were collected during every month in the year and in 21 States, the District of Columbia, Ontario, and New Brunswick. A few of the western subspecies (*Dryobates pubescens gairdneri*), from British Columbia, have been included. The stomachs contained 74 percent of insects, 25 percent of vegetable matter, and 1 percent of mineral matter or sand. The insects belong to the following orders: Ants (*Hymenoptera*), beetles (*Coleoptera*), bugs (*Hemiptera*), flies (*Diptera*), caterpillars (*Lepidoptera*), and grasshoppers (*Orthoptera*). Spiders and myriapods were also present. While all of these were eaten to some extent, they appear in widely different proportions. The ants constitute almost one-third of all the animal food, or about 23 per cent of the whole, indicating a very decided taste for this rather acid and highly flavored article of diet. Beetles stand a little higher in order of importance, amounting to about one-third of the entire insect food, or somewhat more than 24 percent of all. Many of these belong to the family of May beetles, a few were the predaceous ground beetles, but by far the greatest number were wood-boring larvæ, a fact showing that this little bird while securing his dinner is doing good work for the forest. One-fifth of the animal food, or 16 percent of the total, consists of caterpillars, many of which apparently are wood-boring species; others are kinds that live on stems and foliage. Among insects the most interesting are the bugs (*Hemiptera*), which are represented in the stomachs by several species, notably by plant lice (*Aphides*), which in several instances were found in considerable quantities, amounting to 4 percent of the whole food. From the minute size and very perishable nature of these insects it is evident that they must disappear from the stomach in a very short time, and it is fair to infer that many more were eaten than shown by the food remains. Spiders, including harvestmen or daddy longlegs, were eaten freely, and amounted to nearly one-tenth of thewhole. A few bits of snail shell were found in one stomach.

Eleven Downy Woodpeckers from Kansas collected in winter (December) deserve special notice. Eight of them had eaten the eggs of grasshoppers to an average extent of 10 percent of all their food. This, besides being in itself a good work, emphasizes the fact that this bird resorts to the ground for food in case of necessity.

Prof. Samuel Aughey examined 4 stomachs of the Downy Woodpecker in Nebraska, all of which contained grasshoppers.

The late Dr. Townend Glover, entomologist of the Department of Agriculture, states that the stomach of a Downy Woodpecker shot in February "was filled with black ants." He states further, "On one occasion a Downy Woodpecker was observed by myself making a number of small, rough-edged perforations in the bark of a young ash tree, and upon examining the tree when the bird had flown it was found that wherever the bark had been injured the young larvæ of a wood-eating beetle had been snugly coiled underneath and had been destroyed by the bird."[1]

In the matter of vegetable diet, the taste of the Downy Woodpecker is varied, prompting him to eat a little of a good many things rather than a large quantity of any one. The following is a list of the vegetable substances that were identified:

Grain:
- Indeterminable.

Fruit:
- Dogwood berries (*Cornus florida*), (*C. alternifolia*), and (*C. asperifolia*).
- Virginia creeper berries (*Parthenocissus*[2] *quinquefolia*).
- June or service berries (*Amelanchier canadensis*).
- Strawberries (*Fragaria*).
- Pokeberries (*Phytolacca decandra*).
- Apples.
- Unidentified.

Miscellaneous:
- Poison ivy seeds (*Rhus radicans*).
- Poison sumac seeds (*Rhus vernix*).
- Harmless sumac seeds (*Rhus sp. ?*).
- Mullein seeds (*Verbascum thapsus*).
- Hornbeam seeds (*Ostrya virginana*).
- Nut, unidentified.
- Flower petals and buds.
- Galls.
- Cambium.
- Seeds, unidentified.
- Rubbish.

Material believed to be fragments of grain was found in 2 stomachs but the quantity was so small that it may be dismissed without further comment. Fruit is by far the largest item of vegetable diet, forming one-tenth of the whole food. Strawberry seeds were found in only 1 stomach, apple pulp was supposed to be identified in 2, and the other varieties mentioned in the table were distributed in about the same proportion; so that no great economic interest can attach to this part of the birds' diet. The seeds and other things included under the head 'Miscellaneous' constitute about one-twelfth of the total food. Seeds of poison ivy were found in 20 stomachs and poison sumac in 1. These plants, far from being harmful to the birds, seem to form a very agreeable article of diet, and are eaten by many species. Unfortunately these seeds are protected by a hard, horny covering which successfully resists the action of the stomach, so that they pass through the alimentary canal uninjured. It is probable that we owe to birds, more than any other agency, the presence of these noxious plants beside fences, copses, and hedge rows. The remaining vegetable food, about 5 percent, was classed as rubbish, and will be discussed in connection with some of the other woodpeckers.

No beechnuts were found in any of the stomachs examined, but Dr. Merriam informs me that in northern New York they feed extensively on this nut, particularly in fall, winter, and early spring. On April 5,

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[1] U. S. Agr. Rept. for 1865, 1866, p. 37–38.

[2] Commonly called *Ampelopsis*. See (List of Pteridophyta and Spermatophyta), prepared by a committee of the Botanical Club of the A. A. A. S., 1893–94, which has been followed in all questions of botanical nomenclature.

1878, Dr. Merriam "shot 4 Downy Woodpeckers all of whose gizzards were full of beechnuts and contained nothing else. The birds were often seen on moss-covered logs, and even on the ground, searching for the nuts exposed by the melting snow." Dr. Merriam states also that he has seen this woodpecker in the fall eat the red berries of the mountain ash.

HAIRY WOODPECKER.

(*Dryobates villosus.*)

This woodpecker is as common as the Downy in most parts of the United States, and to the ordinary eye can only be distinguished by its greater size, its color and markings being almost exactly the same.

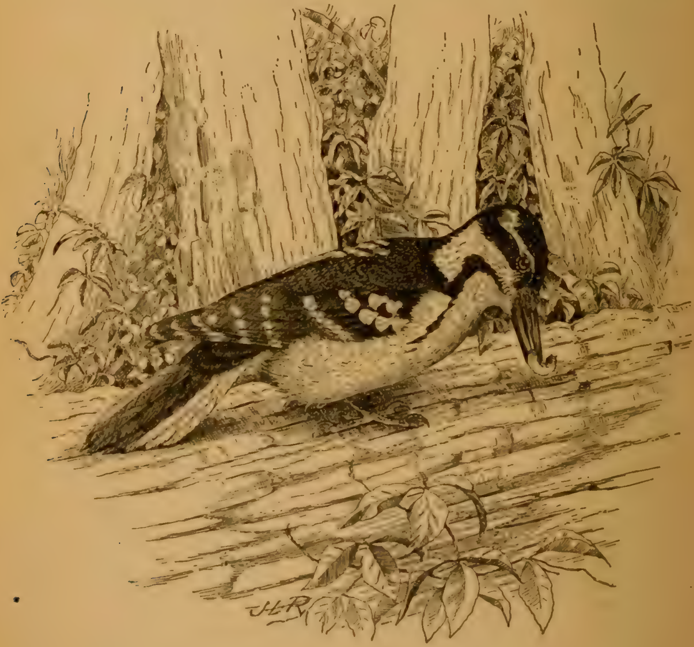

FIG. 1.—Hairy Woodpecker.

The Hairy is a noiser bird, however, often making his presence known by loud calls and obtrusive behavior and by rapid flights from tree to tree. Like the Downy, he has been accused of depredations on fruit, but the stomachs examined do not show that cultivated varieties form any considerable part of his fare. Beside the general resemblance between the two birds there is also a remarkable similarity in their food habits, as shown by the stomach contents; the greatest difference being that the Hairy eats a smaller percentage of insects than the Downy. Eighty-two stomachs have been examined, collected during every month in the year, except February; and coming from 19 States, the District of Columbia, Ontario, New Brunswick, and Nova Scotia; though most were from the northern United States. The proportion of different kinds of food is as follows: Animal, 68 percent; vegetable, 31 percent; mineral, 1 percent. The insect material was made up of ants, beetles, caterpillars, bugs, and grasshoppers. Spiders and myriapods also were present. An inspection of the percentages shows that ants are not so highly prized by the Hairy as by the Downy, since they constitute only about 17 percent of the whole food, or one-fourth of the insect portion. Beetles, both larval and adult, stand relatively higher than in the case of the Downy, comprising 24 percent of all food, or more than one-third of the insect matter. Caterpillars were eaten in greater quantities, both actually and relatively, amounting to 21 percent of the whole food, or more than one-third of all the insect material. Spiders are well represented, and aggregate nearly 6 per cent of the entire food. Among the miscellaneous insects were a few aphids or plant lice. Grasshoppers were found in only 1 stomach, but Professor Aughey found them in 4 out of 6 stomachs examined by him in Nebraska.

Mr. F. M. Webster states that he has seen a Hairy Woodpecker successfully peck a hole through the parchment-like covering of the cocoon of a Cecropia moth, devouring the contents. On examining more than 20 cocoons in a grove of boxelders he found only 2 uninjured.

The Hairy Woodpecker selects a somewhat larger variety of vegetable food than the Downy, though of the same general character. The following list of fruits and seeds found in the stomachs does not indicate that the bird visits orchards and gardens for fruit so much as swamps and thickets, where wild grapes, woodbine, and dogwood bound:

Grain:
- Corn.

Fruit:
- Dogwood berries (*Cornus florida* and *C. asperifolia*).
- Virginia creeper berries (*Parthenocissus quinquefolia*).
- June or service berries (*Amelanchier canadensis*).
- Spice berries (*Benzoin benzoin*).
- Sourgum berries (*Nyssa aquatica*).
- Wild black cherries (*Prunus serotina*).
- Choke cherries (*Prunus virginiana*).
- Wild grapes (*Vitis cordifolia*).

Fruit—Continued:
- Blackberries or raspberries (*Rubus*).
- Pokeberries (*Phytolacca decandra*).
- Unidentified.

Miscellaneous:
- Poison ivy seeds (*Rhus radicans*).
- Poison sumac seeds (*Rhus vernix*).
- Harmless sumac seeds (*Rhus glabra*).
- Barngrass seeds (*Chamæraphis. sp?*).
- Hazelnuts.
- Seeds unidentified.
- Cambium.
- Spruce foliage (*Picea*).
- Rubbish.

The only grain discovered was corn, which was found in 2 stomachs. In one case it was green corn in the milk, but this is hardly sufficient to prove the habit of eating corn. Fruit aggregates a little more than 11 percent of the food of the species, and is fairly distributed among all the items in the above list. Since blackberries are the only kind of cultivated fruit found in the stomachs, and since they grow wild in abundance, it is evident that the Hairy Woodpecker does not at present cause any great damage by his fruit-eating habits. The substances in the miscellaneous list form about 11 percent of the whole food, and are practically of the same character as in the case of the Downy. Poison ivy seeds were eaten by 7 birds, and poison sumac by only 1, so that not so many seeds of these undesirable shrubs are distributed by the Hairy as by the Downy. The weed seeds in the stomachs were few in number, but in Iowa both the Hairy and the Downy Woodpeckers feed largely on weed seeds in winter, stomachs taken then containing little else. Rubbish amounts to about one-twelfth of all their food, which is the largest percentage shown by any species.

Dr. Merriam informs me that in northern New York the Hairy Woodpecker, like the other woodpeckers of the Adirondack region, feeds largely on beechnuts. In late fall, winter, and early spring following good yields of beechnuts the nuts form the principal food of the woodpeckers.

FLICKER.

(*Colaptes auratus.*)

This bird, one of the largest and best known of our woodpeckers, is more migratory than either the Hairy or Downy, in winter being scarce or absent from its breeding range in the Northern States, where it is very abundant in summer and early fall. The Yellow-shafted Flicker is distributed throughout the United States east of the Rocky Mountains. In the West it is replaced by the Red-shafted Flicker, which may be considered the same so far as food habits are concerned. Under one or the other of its various titles of Flicker, Golden-winged Woodpecker, High-holder, Yellow-hammer, Pigeon Woodpecker, and Hairy-wicket, it is known to every farmer and schoolboy and, unfortunately, to certain so-called sportsmen also, for this is the one woodpecker that is often seen in city markets. In most places it is a much shyer bird than either of the preceding, and while it frequents the farm and approaches buildings freely it keeps more in the tops of the trees and does not allow so near an approach of its greatest enemy, man. This is particularly true in the northeastern part of the country, where large bags of Pigeon Woodpeckers are annually made among the wild cherry trees in which the birds feed. The Flickers soon learn whom they have to fear, and such knowledge seems to be hereditary. They are very prolific, rearing from six to ten young at a brood, and so keep reasonably abundant in most parts of the country. The Flicker is the most terrestrial of all the woodpeckers, in spite of his high-perching and high-nesting proclivities, and may often be seen walking about in the grass like a meadow lark.

In the investigation of its food habits 230 stomachs were examined, taken in every month of the year, although January and February have but 1 each. They were collected in 22 States, the District of Columbia, and the Northwest Territory, and are fairly well distributed over the region east of the Rocky Mountains. They contained 56 per cent of animal matter, 39 percent of vegetable, and 5 percent of mineral. It will be seen that the quantity of animal or insect material is less than in either of the preceding species, and the mineral matter somewhat greater. The following orders of insects were represented:

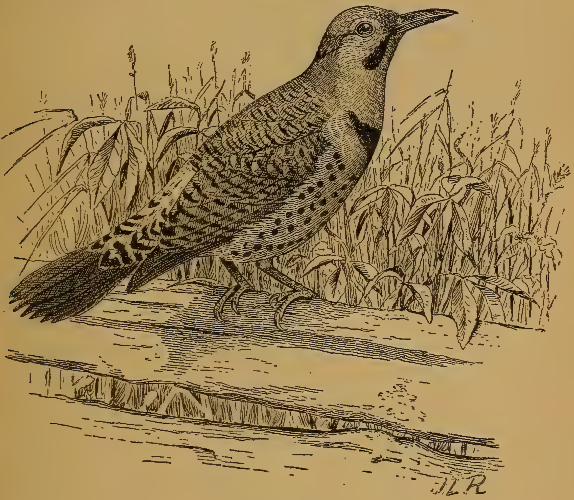

FIG. 2.—Flicker.

Ants (*Hymenoptera*), beetles (*Coleoptera*), bugs (*Hemiptera*), grasshoppers and crickets (*Orthoptera*), caterpillars (*Lepidoptera*), May flies (*Ephemerida*) and white ants (*Isoptera*). Spiders and myriapods also were present. An inspection of this insect matter shows the rather remarkable fact that more than three-fourths of it, or 43 percent of the whole food, consists of ants. If the mineral matter is thrown out as not being properly food, we find that more than 45 percent of the Flicker's food for the year consists of ants. Among the stomachs examined several contained nothing but ants. In two of these the actual number of ants present in each stomach exceeded 3,000. These were mostly small species that live in burrows in the earth, so that it is evident that when Flickers are seen upon the ground they are usually in search of ants, although the other insects found in the stomachs account in part for this ground-feeding habit. Prof. Samuel Aughey examined 8 stomachs of Flickers in Dixon County, Nebr., in June, 1865. All of them contained grasshoppers, and the number in each stomach varied from 15 to 48.

As a large part of the food of the 7 woodpeckers studied consists of ants, the question may be asked whether the birds are doing good or harm by destroying them. There are so many different species of these insects, and they have such widely different habits, that it is difficult to make any assertion that will apply to all, but it is safe to say that many kinds are decidedly harmful, because they attend, protect, and help to spread plant, root, and bark lice of various species. These lice are among the worst enemies of plant life, and everything which tends to prevent their destruction is prejudicial to the interests of agriculture. Other species of ants destroy timber by burrowing in it; still others, in warmer climates, do much harm to fruit trees by cutting off the leaves and undermining the ground. Many species infest houses and other buildings. Apparently, then, birds do no harm in destroying ants, but on the contrary probably do much good by keeping within bounds these insect pests, whose greater abundance would be a serious injury to man. The Flicker takes the lead in this work, eating ants to the extent of nearly half of his whole food.

Next in importance to ants are beetles, which form about 10 percent of all the food, less than half the quantity eaten by the Hairy and Downy Woodpeckers. Among these were May beetles and their allies, and a few snapping beetles, but the greater number were Carabids or predaceous ground beetles. Most of these were in the adult form, but some larvæ of tiger beetles were identified. As these last live in burrows in the sand, and as Carabids live upon the ground, their presence in the stomachs again points to the terrestrial habits of the bird. The same is true of the grasshoppers and crickets. None of the other insects mentioned were eaten to any great extent, the whole aggregating only about 3 percent. Two stomachs contained each a single bedbug. Where they were obtained it is as difficult to surmise as it is to understand what motive could prompt the bird to swallow such an insect. Five stomachs contained each a few bits of snail shell.

In the matter of vegetable diet the Flicker has the most extensive list of any of the 7 woodpeckers, and many of the articles of food can only be obtained on the ground or among low bushes. Following is a list of all the vegetable substances identified in the Flicker's stomach:

Grain:
- Corn.
- Buckwheat.

Fruit:
- Dogwood berries (*Cornus florida* and *C. asperifolia*).
- Virginia creeper berries (*Parthenocissus quinquefolia*).
- Hackberries (*Celtis occidentalis*).
- Black alder berries (*Ilex verticillata*).
- Sourgum berries (*Nyssa aquatica*).
- Cat or greenbrier berries (*Smilax glauca*).
- Blueberries (*Vaccinium* sp.).
- Huckleberries (*Gaylussacia* sp.).
- Pokeberries (*Phytolacca decandra*).
- June or service berries (*Amelanchier canadensis*).
- Spice berries (*Benzoin benzoin*).
- Elderberries (*Sambucus canadensis* and *S. pubens*).
- Mulberries (*Morus*).
- Wild grapes (*Vitis cordifolia*).
- Wild black cherries (*Prunus serotina*).
- Choke cherries (*Prunus virginiana*).
- Cultivated cherries.

Fruit—Continued.
- Blackberries (*Rubus*)
- Unidentified.

Miscellaneous:
- Poison ivy seeds (*Rhus radicans*).
- Poison sumac seeds (*Rhus vernix*).
- Harmless sumac seeds (*Rhus copallina* and *R. glabra*).
- Waxberries or bayberries (*Myrica cerifera*).
- Juniper berries (*Juniperus virginiana*).
- Knotweed or smartweed (*Polygonum convolvulus, P. persicaria, P. lapathifolium*).
- Clover seed (*Trifolium repens*).
- Grass seed (*Phleum*).
- Pigweed seed (*Chenopodium*).
- Mullein seed (*Verbascum thapsus*).
- Ragweed (*Ambrosia*).
- Magnolia seed (*Magnolia grandiflora*).
- Acorns (*Quercus*).
- Seed unidentified.
- Cambium.
- Rubbish.

Of the two kinds of grain in the above list corn was identified in 5 stomachs, buckwheat in 1. One of the stomachs containing corn was taken in March and the bird had made a full meal of it, probably because he could get nothing else. Three of the others were collected in September, and the corn was evidently 'in the milk.' The fifth was taken in October, and is of a somewhat doubtful nature.

The Department of Agriculture has received a number of reports that implicate woodpeckers in damage done to crops. The only one of any consequence is from Dr. E. S. C. Foster, of Russell County, Kans., who states that the Red-headed and Golden-winged Woodpeckers damage corn in the roasting ear by tearing open the husks. He does not say for what purpose the husks are torn open, though some observers have declared that the object is to obtain the grub which sometimes infests the ear. The testimony furnished by the stomachs does not indicate that the Golden-wing has much to do with corn stealing, for it appears that out of 98 stomachs taken in September and October, the season of harvest, only 4 contained corn at all, and these in quantities ranging from 4 to 30 percent of the stomach contents. The buckwheat was eaten in September. The Flicker has a rich and varied list of fruit, embracing at least 20 different kinds, nearly all of which are wild.

The two items of grain and fruit together constitute about 25 per cent of the whole food, the grain, however, being of little consequence. With all this fruit eating, the Flicker trespassed upon man's preserves for cherries only, and these were found in only 1 stomach. Several observers, however, have testified that some damage is done. T. J. Parrish, of Cooke County, Tex., states that the Yellow-hammers and small woodpeckers feed on peaches, plums, grapes, and cherries.

Miscellaneous vegetable substances aggregate a little more than 10 percent of the whole food of this bird, and like the fruit list, consist of a variety of elements. Poison ivy seeds were found in 20 stomachs, poison sumac in 5, and bayberries in 14. All these seeds are coated with a white substance resembling wax, and while the quantity is small compared with the size of the seeds, it is probably rich in nutritive properties, for the seeds are a favorite article of winter diet with many birds. A number of weed seeds were found, and if eaten in considerable quantities would be a great argument in the bird's favor, but unfortunately they occurred in only one or two stomachs each, and so may be considered as merely picked up experimentally in default of something better. It is possible that a series of stomachs taken in the winter months might show a larger percentage, as has been observed in the case of other species of birds, including at least 2 woodpeckers. The mineral element of the stomach contents is larger in the Flicker than any of the others, forming 5 percent of the whole. and consisting principally of fine sand. It was noticed that the greatest quantity was present in stomachs containing ants, showing that the sand was picked up accidentally in gathering the ants from their hillocks.

RED-HEADED WOODPECKER.

(*Melanerpes erythrocephalus.*)

The handsome Redhead inhabits suitable localities throughout the United States east of the Rocky Mountains, but is only casual in New England. He is a familiar bird on telegraph poles and fence posts, and seems to prefer these rather unpicturesque objects to other apparently more fruitful hunting grounds. He feeds largely on insects found upon these bare surfaces, but the vegetable matter in his stomach shows that he forages in other pastures also.

Fifty years ago Giraud stated that on Long Island the Red-headed Woodpecker arrives early in April, and during the spring "subsists chiefly on insects. In the summer it frequents the fruit trees, ripe cherries and pears seeming to be a favorite repast. In the fall it feeds on berries and acorns, the latter at this season forming a large portion of its food."[1]

In its fondness for mast it resembles its relative, the California Woodpecker, whose habit of storing acorns is one of its most conspicuous traits. In the northern part of its range, where the oak is replaced by the beech, the Redhead makes the beechnut its principal food. Dr. C. Hart

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[1] Birds of Long Island, by J. P. Giraud, jr., 1844, p. 180.

Merriam has given much testimony under this head.[1] He states that in northern New York, where it is one of the commonest woodpeckers, it subsists almost exclusively on beechnuts during the fall and winter, even picking the green nuts before they are ripe and while the trees are still covered with leaves. He has shown that these woodpeckers invariably remain throughout the winter after good nut yields and migrate whenever the nut crop fails. He says: "Gray Squirrels, Red-headed Woodpeckers, and beechnuts were numerous during the winters of 1871–72, 1873–74, 1875–76, 1877–78, 1879–80, 1881–82, 1883–84, while during the alternate years the squirrels and nuts were scarce and the woodpeckers altogether absent;" and adds that in Lewis County, N. Y., "a good squirrel year is synonymous with a good year for *Melanerpes*, and vice versa." In early spring, following nut years, when the melting snow uncovers the ground, they feed on the beechnuts that were buried during winter. On April 5, 1878, at Locust Grove, N. Y., he shot 6 whose gizzards contained beechnuts and nothing else.

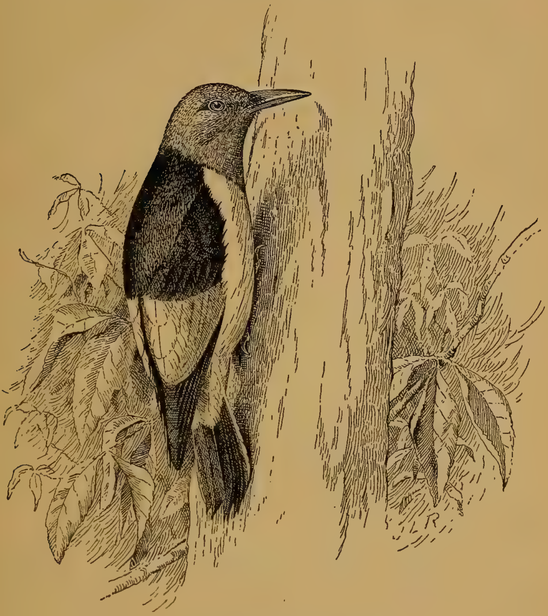

FIG. 3.—Red-headed Woodpecker.

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[1] Birds of Connecticut, 1877, p. 66; Bull. Nuttall Ornith. Club, Vol. III, 1878, p. 124; Mammals of the Adirondacks, 1884, p. 226.

In an interesting article in the Auk,[1] Mr. O. P. Hay says that in central Indiana during a good beechnut year, from the time the nuts began to ripen, the Redheads were almost constantly on the wing, passing from the beeches to some place of deposit. They hid the nuts in almost every conceivable situation. Many were placed in cavities in partly decayed trees; and the felling of an old beech was certain to provide a feast for the children. Large handfuls were taken from a single knot hole. They were often found under a patch of raised bark, and single nuts were driven into cracks in the bark. Others were thrust into cracks in gateposts; and a favorite place of deposit was behind long slivers on fence posts. In a few cases grains of corn were mixed with beechnuts. Nuts were often driven into cracks in the ends of railroad ties; and the birds were often seen on the roofs of houses pounding nuts into the crevices between the shingles. In several instances the space formed by a board springing away from a fence was nearly filled with nuts, and afterwards pieces of bark and wood were brought and driven over the nuts as if to hide them from poachers.

In summer Dr. Merriam has seen the Redheads "make frequent sallies into the air after passing insects, which were almost invariably secured." He has also seen them catch grasshoppers on the ground in a pasture.

Dr. A. K. Fisher saw several Red-headed Woodpeckers feeding on grasshoppers in the streets at Miles City, Mont., in the latter part ot July, 1893. Several of the birds were seen capturing these insects near the hotel throughout the greater part of the forenoon. From a regular perch on top of a telegraph pole or cottonwood they descended on their prey, sometimes eating them on the ground, but more often returned to their former post to devour them.

The following interesting observation was made by Dr. G. S. Agersborg, of Vermillion, S. Dak.:[2]

> Last spring, in opening a good many birds of this species with the object of ascertaining their principal food, I found in their stomachs nothing but young grasshoppers. One of them, which had its headquarters near my house, was observed making frequent visits to an old oak post, and on examining it I found a large crack where the woodpecker had inserted about 100 grasshoppers of all sizes (for future use, as later observation proved), which were put in without killing them, but they were so firmly wedged in the crack that they in vain tried to get free. I told this to a couple of farmers, and found that they had also seen the same thing, and showed me posts which were used for the same purpose. Later in the season the woodpecker whose station was near my house, commenced to use his stores, and to-day (February 10), there are only a few shriveled-up grasshoppers left.

Mr. Charles Aldrich, of Webster City, Iowa, states that he saw a Red-headed Woodpecker catching grasshoppers on the prairie half a mile from timber. In Nebraska grasshoppers were found in 4 out of 6 stomachs examined by Prof. Samuel Aughey.

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[1] Auk. Vol. IV, 1887, pp. 194,195.

[2] Bull. Nuttall Ornith. Club, Vol. III, 1878, p. 97.

Besides depredations upon fruit and grain, this woodpecker has been accused of destroying the eggs of other birds and even of killing the young; and from Florida comes a report that it enters poultry houses and sucks the eggs of domestic fowls. Mr. Charles Aldrich, of Webster City, Iowa, says that a Red-headed Woodpecker was seen to kill a duckling with a single blow on the head, and then to peck out and eat the brains.[1] In view of such testimony remains of eggs and young birds were carefully looked for in the stomachs examined, but pieces of eggshell were found in only 1 stomach of the Flicker and 2 of the Redhead.

A very unusual trait has been recorded by Dr. Howard Jones, of Circleville, Ohio. Dr. Jones says he has seen the Red-headed Woodpecker steal the eggs of eave swallows, and in cases where the necks of the nests were so long that the eggs were out of reach the woodpecker made a hole in the walls of the nest and so obtained the contents. In a colony of swallows containing 'dozens' of nests not a single brood of young was raised. One of the woodpeckers also began to prey upon hens' eggs, and was finally captured in the act of robbing the nest of a sitting hen.[2]

No traces of young birds or of any other vertebrates were discovered in the stomachs of any of the 7 species under consideration, except bones of a small frog which were found in the stomach of a Red-bellied Woodpecker (*Melanerpes carolinus*) from Florida.

The Redhead has been accused of doing considerable damage to fruit and grain, and both charges are fairly well sustained. In northern New York Dr. Merriam has seen it peck into apples on the tree, and has several times seen it feed on choke cherries (*Prunus virginiana*).

Mr. August Jahn, of Pope County, Ark., writes that it has damaged his corn to the amount of $10 or $15, and Dr. J. R. Mathers, of Upshur County, W. Va., says that the same species feeds on cherries, strawberries, raspberries, and blackberries, and that its depredations are sometimes serious. According to Mr. Witmer Stone, of Germantown, Pa., Red-headed Woodpeckers have been observed to strip a blackberry patch of all of its fruit. Mr. W. B. McDaniel, of Decatur County, Ga., also reports that the Sapsucker and Redhead eat grapes and cherries, the loss being sometimes considerable. These examples show the nature of the evidence contributed by eye-witnesses, the accuracy of whose observations there is no reason to doubt. That the stomach examinations do not reveal more damaging points against the species is not surprising, for a person seeing a bird eating his choice fruit, or in some other way inflicting damage, is more impressed by it than by the sight of a hundred of the same species quietly pursuing their ordinary vocations. Thus an occasional act is taken as a characteristic habit.

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[1] Am. Nat., Vol. VI, No. 5, May, 1877, p. 308.

[2] Ornithologist and Oologist, Vol. VIII, No. 7, 1883, p. 56.

One hundred and one stomachs of the Redhead were examined from specimens collected throughout the year, although the bird is not generally abundant in the Northern States during the winter months. The specimens were taken in 20 States, the District of Columbia and Canada, and are fairly well distributed over the whole region east of the Rocky Mountains. The contents of the stomachs consisted of: Animal matter, 50 percent; vegetable matter, 47 percent; mineral matter, 3 percent. The animal and vegetable elements are nearly balanced, and the mineral element is larger than in any except the Flicker. The insects consist of ants, wasps, beetles, bugs, grasshoppers, crickets, moths, and caterpillars. Spiders and myriapods also were found. Ants amounted to about 11 percent of the whole food, which is the smallest showing of any of the 7 species under consideration, and is in harmony with the habits of the bird, which collects its food upon exposed surfaces where ants do not often occur. Beetle remains formed nearly one-third of all food, the highest record of any one of the 7 woodpeckers. The families represented were those of the common May beetle (*Lachnosterna*), which was found in several stomachs, the predaceous ground beetles, tiger beetles, weevils, and a few others. Among the May beetle family is a rather large, brilliant green beetle, known to entomologists as *Allorhina nitida*, but commonly called by the less dignified name of 'June bug.' It is very common during the early summer in the Middle and Southern States, but less so at the North. This insect was found in 11 stomachs, and 5 individuals were identified in a single stomach, which would seem an enormous meal for a bird of this size. Another large beetle eaten by this woodpecker is the fire-ground beetle (*Calosoma calidum*), a predaceous beetle of large size and vile odor. *Passalus cornutus*, one of the staghorns, a large insect, was also found, as well as a pair of mandibles belonging to *Prionus brevicornus*, one of the largest beetles in the United States. A preference for large beetles is one of the pronounced characteristics of this woodpecker. Weevils were found in 15 stomachs, and in several cases as many as 10 were present. Remains of Carabid beetles were found in 44 stomachs to an average amount of 24 percent of the contents of those that contained them, or 10 percent of all. The fact that 43 percent of all the birds taken had eaten these beetles, some of them to the extent of 16 individuals, shows a decided fondness for these insects, and taken with the fact that 5 stomachs contained Cicindelids or tiger beetles forms a rather strong indictment against the bird.

Grasshoppers and crickets formed 6 percent of the whole food, a larger percentage than in any of the other 7 species. The aggregate for all other insects is 4 percent, and the most important kinds are wasps and their allies. As this bird has often been seen capturing insects on the wing[1] it is probable that the wasps were taken in that way.

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[1] See Merriam, Bull. Nuttall Ornith. Club, Vol. III, July, 1878, p. 126; also Forest and Stream, Vol. IX, January 17, 1878, p. 451.

The vegetable food of the Redhead presents considerable variety, and shows some points of difference from that of the other woodpeckers. The following is the list of substances identified:

- Grain:
  - Corn.
- Fruit:
  - Dogwood berries (*Cornus candidissima* and *C. florida*).
  - Huckleberries (*Gaylussacia*).
  - Strawberries (*Fragaria*).
  - Blackberries or raspberries (*Rubus*).
  - Mulberries (*Morus*).
  - Elderberries (*Sambucus*).
  - Wild black cherries (*Prunus serotina*).
  - Choke cherries (*Prunus virginiana*).
  - Cultivated cherries.
  - Wild grapes (*Vitis cordifolia*).
- Fruit—Continued.
  - Apples.
  - Pears.
  - Unidentified.
- Miscellaneous:
  - Sumac seeds (*Rhus copallina* and *R. glabra*).
  - Ragweed seeds (*Ambrosia*).
  - Pigweed seeds (*Chenopodium*).
  - Acorns (*Quercus*).
  - Seeds unidentified.
  - Galls.
  - Flower anthers.
  - Rubbish.

Corn was found in 17 stomachs, collected from May to September, inclusive, and amounted to more than 7 percent of all the food. While it seems to be eaten in any condition, that taken in the late summer was in the milk, and evidently picked from standing ears. This being the largest percentage of grain shown by any of the 7 species corroborates some of the testimony received, and indicates that the Redhead, if sufficiently abundant, might do considerable damage to the growing crop, particularly if other food was not at hand. While the fruit list is not so long as in the case of the Flicker, it includes more kinds that are, or may be, cultivated; and the quantity found in the stomachs, a little more than 33 percent of all the food, is greater than in any of the others. Strawberries were found in 1 stomach, blackberries or raspberries in 15, cultivated cherries in 2, apples in 4, and pears in 6. Fruit pulp was found in 33 stomachs, and it is almost certain that a large part of this was obtained from some of the larger cultivated varieties. Seeds were found in but few stomachs, and only a small number in each.

RED-BELLIED WOODPECKER.

(*Melanerpes carolinus.*)

The Red-bellied Woodpecker is a more southern species than any of the others treated in this bulletin. It is not known to breed north of the Carolinian fauna, and is abundant in Florida and the Gulf States. Curiously enough it sometimes migrates north of its breeding range to spend the winter.

Only 22 stomachs of this species have been obtained by the division. These were collected in 9 States, ranging from Florida to Michigan and from Maryland to Kansas, and in every month except April, June, and July. An examination of their stomachs shows: animal matter (insects)

26 percent and vegetable matter 74 percent. A small quantity of gravel was found in 7 stomachs, but was not reckoned as food. Ants were found in 14 stomachs, and amounted to 11 percent of the whole food. Adult beetles stand next in importance, aggregating 7 percent of all food, while larval beetles only reach 3 percent. Caterpillars had been taken by only 2 birds, but they had eaten so many that they amounted to 4 percent of the whole food. The remaining animal food is made up of small quantities of bugs (*Hemiptera*), crickets (*Orthoptera*), and spiders, with a few bones of a small tree frog found in 1 stomach taken in Florida.

Dr. B. H. Warren states that the stomachs of 3 Red-bellied Woodpeckers captured in winter in Chester and Delaware counties, Pa., contained black beetles, larvæ, fragments of acorns, and a few seeds of wild grapes. The stomachs of 8 adults from the St. Johns River, Florida, contained red seeds of 2 species of palmetto, but no insects. Two additional stomachs from the same locality contained palmetto berries, fragments of crickets (*Nemobius* and *Oracharis saltator*), a palmetto ant (*Camponotus escuriens*), and numerous joints of a myriapod, probably *Julus*.[1]

Dr. Townend Glover found in the stomach of a Red-bellied Woodpecker killed in December "pieces of acorns, seeds, and gravel, but no insects. Another, shot in December, contained wing-cases of *Buprestis*, and a species of wasp or *Polistes*, acorns, seeds, and no bark. A third, shot in May, was filled with seeds, pieces of bark, and insects, among which was an entire *Lachnosterna*, or May bug."[2]

The vegetable food of the Red-bellied Woodpecker contained in the 22 stomachs examined by the division consisted of the following seeds and fruits:

Grain:
- Corn.

Fruit:
- Mulberries (*Morus rubra*).
- Wild grapes (*Vitis cordifolia*).
- Virginia creeper (*Parthenocissus quinquefolia*).
- Elderberries (*Sambucus canadensis*).
- Rough-leaved cornel (*Cornus asperifolia*).

Fruit—Continued.
- Saw palmetto (*Sabal serrulata*).
- Holly (*Ilex opaca*).
- Wild sarsaparilla (*Aralia nudicaulis*).
- Bayberries (*Myrica cerifera*).
- Pine (*Pinus echinata*).
- Poison ivy (*Rhus radicans*).
- Ragweed (*Ambrosia* sp.).

Corn was found in only 2 stomachs. The other items were well distributed, and none of them appear to be specially preferred, unless it may be the poison ivy, which was found in 6 stomachs, and amounted to nearly 12 per cent of the whole food. Although 8 of the 22 birds were collected in Florida, no trace of the pulp of oranges was discovered, but that oranges are eaten by them is shown by the following interesting notes.

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[1] Birds of Pennsylvania 2d ed., 1890, pp. 174, 175.

[2] U. S. Agric. Rept. for 1865, 1866, p. 38.

Dr. B. H. Warren states that in Florida the Red-bellied Woodpecker is commonly known as 'Orange Sapsucker' and 'Orange Borer.' Dr. Warren collected 26 of these woodpeckers in an orange grove near Volusia and found that 11 of them contained orange pulp. Three contained nothing else; the others had eaten also insects and berries.

Corroborating Dr. Warren's account, Mr. William Brewster states that at Enterprise, Fla., in February, 1889, he saw a Red-bellied Woodpecker eating the pulp of a sweet orange. Mr. Brewster states that the woodpecker attacked the orange on the ground, pecking at it in a slow and deliberate way for several minutes. On examining the orange it was found to be decayed on one side. "In the sound portion were three holes, each nearly as large as a silver dollar, with narrow strips of peel between them. The pulp had been eaten out quite to the middle of the fruit. Small pieces of rind were thickly strewn about the spot." Upon searching closely he discovered several other oranges that had been attacked in a similiar manner. All were partially decayed and were lying on the ground. He was unable to find any on the trees which showed any marks of the woodpecker's bill.[1]

Mr. Benjamin Mortimer, writing of the same bird at Sanford, Fla., says:

> During February and March, 1889, while gathering fruit or pruning orange trees, I frequently found oranges that had been riddled by this woodpecker and repeatedly saw the bird at work. I never observed it feeding upon fallen oranges. It helped itself freely to sound fruit that still hung on the trees, and in some instances I have found ten or twelve oranges on one tree that had been tapped by it. Where an orange accidentally rested on a branch in such a way as to make the flower end accessible from above or from a horizontal direction the woodpecker chose that spot, as through it he could reach into all the sections of the fruit, and when this was the case there was but one hole in the orange. But usually there were many holes around it. It appeared that after having once commenced on an orange, the woodpecker returned to the same one repeatedly until he had completely consumed the pulp, and then he usually attacked another very near to it. Thus I have found certain clusters in which every orange had been bored, while all the others on the tree were untouched. An old orange grower told me that the "Sapsuckers," as he called them, never touch any but very ripe oranges, and are troublesome only to such growers as reserved their crops for the late market. He also said that it is only within a very few years that they have shown a taste for the fruit; and I myself observed that, although Red-bellies were very common in the neighborhood, only an individual, or perhaps a pair, visited any one grove.[2]

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[1] The Auk, Vol. VI, 1889, pp. 337–338.

[2] The Auk, Vol. VII, 1890, p. 340.

YELLOW-BELLIED WOODPECKER OR SAPSUCKER.

(*Sphyrapicus varius.*)

This species is probably the most migratory of all our woodpeckers, breeding only in the most northerly parts of the United States, and in some of the mountains farther south. In the fall it ranges southward, spending the winter in most of the Eastern States. It is less generally distributed than some of the other woodpeckers, being quite unknown in some sections and very abundant in others. For instance, Dr. C. Hart Merriam states that in the Adirondack region during migration it outnumbers all other species of the family together, and throughout the summer is second in numbers only to the Hairy Woodpecker; and at Mount Chocorua, New Hampshire, Mr. Frank Bolles found it the most abundant species. In Minnesota also it is very common. On the other hand, near my home in Massachusetts only two or three were observed each year; and during a residence of eight years in Iowa it was noted only three or four times.

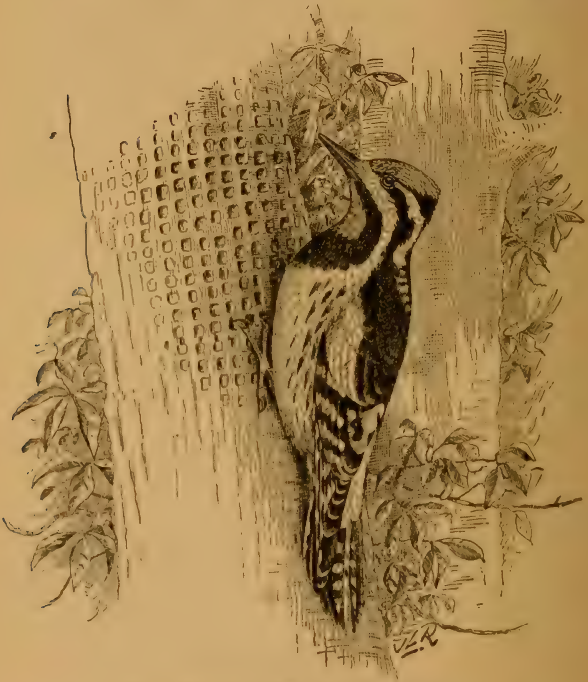

FIG. 4.—Yellow-bellied Woodpecker or Sapsucker.

It is to this species that the term 'Sapsucker' is most often and most justly applied, for it drills holes in the bark of certain trees and drinks the sap. It feeds also on cambium, insects, and wild fruits and berries.

In writing of the habits of these woodpeckers in northern New York in 1878, Dr. Merriam states:

> They really do considerable mischief by drilling holes in the bark of apple, thornapple, and mountain ash trees in such a way as to form girdles of punctures, sometimes 2 feet or more in breadth (up and down), about the trunks and branches. * * * The holes, which are sometimes merely single punctures, and sometimes squarish spaces (multiple punctures) nearly half an inch across, are placed so near together that not unfrequently they cover more of the tree than the remaining bark. Hence, more than half of the bark is sometimes removed from the girdled portions, and the balance often dries up and comes off. Therefore it is not surprising that trees which have been extensively girdled generally die, and mountain ash are much more prone to do so than either apple or thornapple trees, due, very likely, to their more slender stems. The motive which induces this species to operate thus upon young and healthy trees is, I think, but partly understood. It is unquestionably true that they feed, to a certain extent, both upon the inner bark and the fresh sap from these trees, but that the procurement of these two elements of sustenance, gratifying as they doubtless are, is their chief aim in making the punctures I am inclined to dispute. As the sap exudes from the newly-made punctures, thousands of flies, yellow jackets, and other insects congregate about the place, till the hum of their wings suggests a swarm of bees. If, now, the tree be watched, the woodpecker will soon be seen to return and alight over the part of the girdle which he has most recently punctured. Here he remains, with motionless body, and feasts upon the choicest species from the host of insects within easy reach. * * * In making each girdle they work around the trunk, and from below upwards, but they may begin a new girdle below an old one. They make but few holes each day, and after completing two or three remain over the spot for some little time, and as the clear fresh sap exudes and trickles down the bark they place their bill against the dependent drop and suck it in with evident relish—a habit which has doubtless given rise to the more appropriate than elegant term Sapsucker, by which they are commonly known in some parts of the country. I have several times watched this performance at a distance of less than 10 feet, and all the details of the process were distinctly seen, the bird looking at me, meanwhile, 'out of the corner of his eye.' When his thirst is satisfied he silently disappears, and as silently returns again, after a few hours, to feast upon the insects that have been attracted to the spot by the escaping sap. This bird, then, by a few strokes of its bill, is enabled to secure both food (animal and vegetable) and drink in abundance for an entire day; and a single tree, favorably situated, may suffice for a whole season.[1]

The late Frank Bolles has published some interesting detailed observations respecting the food habits of the Sapsucker. His conclusions are:

> That the Yellow-bellied Woodpecker is in the habit for successive years of drilling the canoe birch, red maple, red oak, white ash, and probably other trees, for the purpose of taking from them the elaborated sap, and in some cases parts of the cambium layer; that the birds consume the sap in large quantities for its own sake and not for insect matter which such sap may chance occasionally to contain; that the sap attracts many insects of various species, a few of which form a considerable part of the food of this bird, but whose capture does not occupy its time to any-

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[1] Bull. Nuttall Ornith. Club, Vol. IV, January, 1879, pp. 3–5.

> thing like the extent to which sap drinking occupies it; * * * that the forest trees attacked by them generally die, possibly in the second or third year of use; that the total damage done by them is too insignificant to justify their persecution in well-wooded regions.[1]

Mr. Bolles shot 8 Sapsuckers in July and August, 1890. Their stomachs "were well filled with insects." Some of these were examined by Mr. Samuel H. Scudder, who states:

> The insects in the different stomachs are in all cases almost exclusively composed of the harder chitinous parts of ants. In a cursory examination I find little else, though one or two beetles are represented, and No. 4 must have swallowed an entire wasp of the largest size, his head and wings attesting thereto.[2]

In a subsequent article Mr. Bolles gives the result of an attempt to keep several young Sapsuckers alive on a diet of dilute maple sirup. Unfortunately for the experiment, the birds obtained and greedily devoured numerous insects attracted to the cage by the sirup. How many of the insects were eaten was not known, but all of the birds died within four months. Examination of their bodies showed fatty degeneration of the liver—a condition said to be usual in cases of starvation. Mr. Bolles states:

> The most probable cause of this enlargement of the liver, which seems to have been the reason for the death of the 3 Sapsuckers, was an undue proportion of sugar in their diet. In a wild state they would have eaten insects every day and kept their stomachs well filled with the chitinous parts of acid insects. Under restraint they secured fewer and fewer insects, until, during the last few weeks of their lives, they had practically no solid food of any kind.[3]

Mr. Bolles has thus proved by experiment that concentrated sap (saturated with sugar) is not sufficient to sustain life, even with the addition of a small percentage of insects. The logical inference is that sap, while liked by the birds and consumed in large quantities, holds a subordinate place as an article of food.

The Yellow-bellied Woodpecker is represented in the collection by 81 stomachs, distributed rather irregularly through the year. None were taken in February, March, or November, and only a few in January, June, and December; the great bulk were collected in April, August, September, and October. They were obtained from 15 States, the District of Columbia, and Nova Scotia. All were from the Northern States, except a few from North Carolina, Virginia, and the District of Columbia. Unlike any of the preceding species the vegetable element of the food here exactly equals the animal part. The insect matter was made up of ants, wasps, beetles, flies, bugs, grasshoppers, crickets, and mayflies. Some spiders also were present. Of the whole food, 36 percent consisted of ants, a higher percentage than in any other woodpecker except the Flicker. Beetles amounted to 5 percent, and do not appear to be a favorite food. Flies (*Diptera*) in various forms were eaten in larger numbers than by any of the others. Among them were several long-legged crane flies (*Tipulids*). Spiders were eaten to a small extent only, and most of these were phalangers or 'daddy-longlegs,' which, taken with the crane flies, would indicate a slight preference for long-legged prey. Bugs, wasps, caterpillars, crickets, and mayflies collectively amount to about 6 percent, no one of them reaching any very important figure. Prof. Samuel Aughey examined 5 stomachs of the Yellow-bellied Woodpecker in Nebraska, all of which contained grasshoppers. The number in each stomach varied from 15 to 33.

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[1] The Auk, Vol. VIII, July, 1891, p. 270.

[2] The Auk, Vol. VIII, July, 1891, p. 269.

[3] The Auk, Vol. IX, April, 1892, p. 119.

Mr. William Brewster states that at Umbagog Lake, Maine, "After the young have hatched, the habits of the Yellow-bellied Woodpecker change. From an humble delver after worms and larvæ, it rises to the proud independence of a flycatcher, taking its prey on wing as unerringly as the best marksman of them all. From its perch on the spire of some tall stub it makes a succession of rapid sorties after its abundant victims, and then flies off to its nest with bill and mouth crammed full of insects, principally large Diptera."[1]

The vegetable food of the Sapsucker is varied. The following fruits and berries were found in the stomachs:

Fruit:
- Dogwood berries (*Cornus florida*).
- Black alder berries (*Ilex verticillata*).
- Virginia creeper berries (*Parthenocissus quinquefolia*).
- Wild black cherries (*Prunus serotina*).
- Blackberries or raspberries (*Rubus*).
- Unidentified.

Miscellaneous:
- Poison ivy seeds (*Rhus radicans*).
- Mullein seeds (*Verbascum thapsus*).
- Juniper berries (*Juniperus virginiana*).
- Buds.
- Seeds unidentified.
- Cambium.
- Rubbish.

The quantity of fruit found in the stomachs formed 26 percent of the entire food, but the only kinds identified that might possibly be cultivated were blackberries and raspberries, and these were in only 2 stomachs. Unidentifiable fruit pulp was found in 12 stomachs. Miscellaneous seeds to the amount of 5 percent complete the list of substances eaten by this species. Poison ivy seeds were found in only 1 stomach, and most of the other things were distributed in about the same proportion.

Dr. Merriam informs me that in the fall in northern New York the Sapsuckers feed on ripening beechnuts, the small branches bending low with the weight of the birds while picking the tender nuts.

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[1] Bull. Nuttall Ornith. Club, Vol. I, 1876, No. 3, p. 69.

GREAT PILEATED WOODPECKER.

(*Ceophlœus pileatus.*)

Excepting the Ivory Bill this is the largest woodpecker in the United States, where it inhabits most of the heavily wooded districts. It is shy and retiring, seldom appearing outside of the forests, and difficult to approach even in its favorite haunts. Its large size, loud voice, and habit of hammering upon dead trees render it conspicuous. Its strength is marvelous, and one unacquainted with it can scarcely credit a bird with such power of destruction as is sometimes shown by a stump or dead trunk on which it has operated for ants or boring larvæ.

Only 23 stomachs of the Pileated Woodpecker have been obtained; all taken in the months of October, November, December, and January, and collected from 6 States, the District of Columbia, and Canada (including New Brunswick). Fifty-one percent of the contents of these stomachs consisted of animal matter or insects; 49 percent of vegetable matter. The insects were principally ants and beetles, with a few of some other orders. The ants were mostly of the larger species that live in decaying wood. A large proportion of the beetles were in the larval form, and all were of the wood boring species. There were also a few caterpillars, also wood-borers, a few plant lice, several cockroaches of the species that live under the bark of dead trees, a few white ants and a few flies, with one spider.

The gizzard of a Pileated Woodpecker shot by Dr. Merriam in the Adirondacks, April 25, 1882, contained hundreds of large ants and no other food. Six stomachs, collected by Dr. B. H. Warren on the St. Johns River in Florida, contained numerous palmetto ants (*Campanotus escuriens*), and remains of other ants, several larvæ of a Prionid beetle (*Orthosoma brunnea*), numerous builder ants (*Cremastogaster lineolata*), one larva of *Xylotrechus*, and one pupa of the white ant (*Termes*). The insects were determined under Prof. C. V. Riley.[1]

Seeds and berries of the following plants were found in the stomachs examined by the division:

Sourgum (*Nyssa aquatica*).
Flowering dogwood (*Cornus florida*).
Black haw (*Viburnum prunifolium*).
Cassena (*Ilex cassine*).
Hackberry (*Celtis occidentalis*).
Persimmon (*Diospyros virginiana*).
Wild grapes (*Vitis cordifolia*).
Virginia creeper (*Parthenocissus quinquefolia*).
Greenbrier (*Smilax rotundifolia* and *S. glauca*).
Sumac (*Rhus copallina*).
Poison sumac (*Rhus vernix*).
Poison ivy (*Rhus radicans*).

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[1] Birds of Pennsylvania, 2d ed., 1890, p. 177.

In addition to the 7 species of woodpeckers whose food has been already discussed, 57 stomachs have been examined, belonging to 12 species and subspecies, mostly from the southern and western parts of the United States and British Columbia, as follows:

	Stomachs.
Nuttall's Woodpecker (*Dryobates nuttalii*)	7
Red-cockaded Woodpecker (*Dryobates borealis*)	12
Baird's Woodpecker (*Dryobates scalaris bairdi*)	3
Gilded Flicker (*Colaptes chrysoides*)	3
Red-shafted Flicker (*Colaptes cafer*)	11
Northwestern Flicker (*Colaptes cafer saturatior*)	5
California Woodpecker (*Melanerpes formicivorus bairdi*)	1
Lewis's Woodpecker (*Melanerpes torquatus*)	3
Gila Woodpecker (*Melanerpes uropygialis*)	1
Red-breasted Sapsucker (*Sphyrapicus ruber*)	1
Arctic Three-toed Woodpecker (*Picoides arcticus*)	7
Alpine Three-toed Woodpecker (*Picoides americanus dorsalis*)	3

With such a small number of stomachs it is hardly worth while to discuss the food of each species. The Three-toed Woodpeckers (*Picoides*), however, deserve passing notice, since their food contains a larger percentage of wood-boring larvæ than any other woodpecker examined. As the food of the two species is practically the same they may be considered together. The contents of the 10 stomachs consists of: animal matter, 83 percent; vegetable matter, 17 percent. It is a question whether this should not all be considered as animal, for the vegetable portion consisted almost entirely of rotten wood and similar rubbish, probably taken accidentally, and is not in any proper sense food, the exception being in one case where a little cambium had been eaten by one individual of the Arctic Three-toed Woodpecker (*Picoides arcticus*) and a few skins of some small fruit by one Alpine Three-toed Woodpecker (*P. americanus dorsalis*). The animal food consisted of 63 per cent of wood-boring Coleopterous larvæ (beetles), 11 percent of Lepidopterous larvæ (caterpillars), probably also wood-borers, and 9 per cent of adult beetles, ants, and other Hymenopterous insects.

THE TONGUES OF WOODPECKERS.[1]

RELATION OF THE FORM OF THE TONGUE TO THE CHARACTER OF THE FOOD.

By FREDERIC A. LUCAS,

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Whether the tongues of birds are of value in classification, or whether the modifications of the tongue, at least the external modifications, are due to adaptation to the character of the food or the manner in which food is manipulated, is a question of much interest. Unfortunately the food and feeding habits of birds are so little known that in many cases the adaptive characters of the tongue are not recognized, since without a knowledge of the one it is difficult or impossible to explain the peculiarities of the other.

The results of the preliminary investigation of the food of North American woodpeckers, made by the Division of Ornithology and Mammalogy of the Department of Agriculture, suggested that this group would be a most excellent one to study, and the tongues of all available species have been examined.

The woodpeckers are structurally a well-marked, compact group, and any variation in the structure of a given part, if shown to be directly correlated with some peculiarity of habit, would be a good indication that the one was dependent on the other. A comparison of the structure and modifications of the tongue with the results obtained from the examination of a large series of stomachs will, it is thought, show that just such a correlation does exist between the two, and that the form of the tongue varies surprisingly according to the nature of the food.

It is of course always necessary to bear in mind that the food of a bird necessarily varies with the season—a fact well shown by the group under consideration—and consequently that the peculiarity of the tongue may be related to some special kind of food, or particular method of obtaining it, pursued during a portion of the year only. A particular kind of food which could be best obtained by some special adaptive feature would naturally have more influence as a modifying agent, even if indulged in for only a short time, than a general diet for a long period, since the one would be positive in its effects, the other negative.

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[1] Published by permission of Dr. G. Brown Goode, Director United States National Museum.

As the hyoid bone is the framework on which the tongue is built, it will be well to note some of its characteristic features in the woodpeckers before proceeding to the modifications of the tongue itself. The hyoid is so constructed as to combine the two characters of length and strength that are needed for extensile purposes. The front of the hyoid is formed by the short, fused cerato-hyals, although a groove, or in some cases a perforation, indicates the double origin of this bone. The basi-hyal is usually very long and very slender and the cerato-branchials abut upon its posterior end, the basi-branchial being absent, nor have any indications of this bone been found even in very young specimens. The cerato-branchials and epi-branchials are variable, especially the latter, which, as in the Sapsucker (*Sphyrapicus*), may be no longer than in many Passeres, or, as in the Flickers (*Colaptes*), reach the maximum length among birds. The epi-branchials curve up over the back of the skull, meet on its summit, and continue on toward the forehead. In other long-tongued birds, as in the humming bird (*Trochilus*), for example, the apposed bones reach to the base of the bill, but in the longest-tongued, woodpeckers they turn to the right, pass through the right narial opening, dipping under the nostril, and thence continue quite to the tip of the bill, so that in these species the extreme possible length of tongue is reached unless some other device is resorted to.[1] The cerato-branchials lie side by side when the tongue is protruded, and even when it is withdrawn they are posteriorly but little separated. The general character of the hyoid is constant in all species examined, but, as just stated, the proportions of its component parts vary, the extremes being represented by the Sapsucker (*Sphyrapicus*) and Flicker (*Colaptes*), both of which are figured (Pl. III, figs. 1, 3).

Externally the tongue consists at the tip of a horny portion more or less barbed along the edges; this is followed by a section covered with tough skin bearing on the upper surface a long patch of minute points, while the basal portion is clothed with smooth, elastic skin, which is more or less wrinkled tranversely when the tongue is retracted. The skin covering the base of the tongue is reflected, forming a sort of sheath, into which the basal part of the tongue is withdrawn when at rest. The shape of the patch of minute points, as well as the number and character of the points themselves, seems to vary in different species, and, although these points are so small as to appear like mere granulations, they are seen under the microscope to have a perfectly definite form and to be directed backward (Pl. III, figs 8, 9.) They are smallest toward the front of the patch, and increase in size from thence backward.

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[1] It would appear that a method is already in use by which the length of the tongue can be greatly increased, and this is the curling of the free ends of the epi-branchials into a spiral. Although I have never met with a specimen in which the hyoid was so arranged, both Dr. Bryant and Mr. Wm. Palmer have recorded specimens in which the hyoid encircled the eye. Dr. Bryant's paper, entitled "Remarks on *Sphyrapicus varius*, Linn.," appeared in Proc. Bost. Soc. Nat. Hist., Vol. X, 1864-'66, pp. 91-93.

The anterior, horny portion of the tongue is also subject to great variation. In most species it is armed on either side with a number of sharp, backwardly-directed spines, but these may vary in number from two or three in the Flicker (*Colaptes*, Pl. II, fig. 10), up to thirty or forty in the Redhead (*Melanerpes*, Pl. II, fig. 2). One specimen of Flicker, labeled *Colaptes hybridus*, Pl. I, fig. 1), had the tip of the tongue wholly unarmed; but this may have been an individual peculiarity, and if so, would be interesting as showing the retention in the adult of the condition found in the young. In the Sapsucker (*Sphyrapicus*) the tongue bears no spines, but two series of stiff hairs, the lower set directed outward, the upper series backward. Of course, strictly speaking, these hairs are simply very slender spines, and in the California Woodpecker (*Melanerpes formicivorous bairdi*, Pl. II, fig. 1) we find an almost intermediate stage, the spines being quite fine, and the sides of the tongue, as in a few other species, furnished with a few short hairs lying below the spines and directed outward and forward.

In very young woodpeckers the tongue is unarmed at the point, bearing neither hairs nor spines, although the patch of minute points on the upper surface is present from the first. Later on, as indicated by a fully-fledged nestling of the Downy Woodpecker (*Dryobates pubescens*, Pl. III, fig. 6), a species whose tongue, when adult, is armed with sharp barbs, the spines are represented by short, fine, reflexed hairs, like the upper series of the Sapsucker (*Sphyrapicus varius*). Thus it would seem that the lateral spines are acquired after the bird has commenced to fly, and that they must be developed very rapidly, although specimens showing the various stages in their acquisition are lacking. The growth of the hyoid must be correspondingly rapid, for in the nestling alluded to the ends of the epi-branchials reached only to the center of the skull, although the Downy is a long-tongued bird whose hyoid runs beneath the nostril into the bill. This rapid growth has been observed in the hyoid of humming birds, in which the growth of the bill is also very rapid after hatching, and it would appear that great changes take place in the tongue and beak about the time the young bird ceases to be fed and begins to feed itself.

If woodpeckers were to be classified by their tongues we would start with forms like Delattre's Woodpecker (*Ceophlœus scapularis*, Pl. II, fig. 11), and Flicker (*Colaptes auratus* or *C. chrysoides*, Pl. II, fig. 10), in which the tongue is armed with two or three points on each side; pass through the Pileated Woodpecker (*Ceophlœus pileatus*, Pl. II, fig. 9), into the White-headed Woodpecker (*Xenopicus albolarvatus*, Pl. II, fig. 8). and Downy Woodpecker (*Dryobates pubescens*, Pl. II, fig. 4), and thence to such species as the Gila Woodpecker (*Melanerpes uropygialis*, Pl. II, fig. 6). Thence through the Three-toed Woodpecker (*Picoides*, Pl. II, fig. 5) and the Ladder-back Woodpecker (*Dryobates scalaris*, Pl. II, fig. 3), we reach the Redhead Woodpecker (*Melanerpes erythrocephalus*, Pl. II, fig. 2) and California Woodpecker (*Melanerpes formicivorus bairdi*, Pl. II, fig. 1), while between these and the short, brush-tongued Sapsucker (*Sphyrapicus*, Pl. I, fig. 12), there is a gap to be bridged over.

Considering the tongues in relation to food, we find that those of the various species of Flickers (*Colaptes*. Pl. I, fig. 3) have the fewest terminal barbs and the longest dorsal tract of fine points; they are also among the longest. The members of the genus are particularly fond of ants, and the tongue seems especially adapted for probing ant hills. The function of the fine points on the upper part of the tongue seems to be to form a rough surface to which the sticky saliva will readily adhere and to which in turn the ants will be stuck. In this genus the submaxillary salivary glands reach the maximum size in the group.

The Hairy and Downy Woodpeckers (*Dryobates villosus* and *D. pubescens*, Pl. I, fig. 4), and also the Pileated Woodpecker (*Ceophlœus pileatus*) feed more or less on the larvæ of beetles (*Coleoptera*), and these have sharply barbed tongues, well adapted for spearing grubs or for coaxing them out of their hiding places. Hence it seems extremely probable that other species similarly provided have similar food habits. In these species, and in others with sharply barbed tongues, the dorsal tracts of points vary in shape and extent as well as in the size and number of the points, but in none are they as long as in the Flicker (*Colaptes*). The same is true of the submaxillary glands, which are all smaller than in the Flicker.

The Red-headed Woodpecker (*Melanerpes erythrocephalus*, Pl. I, fig. 9), although having a peculiar tongue, has one which is less evidently specialized than those of other species, and one which suggests the fringed tongues of some finches and other passerine birds. In diet this bird appears to be the most omnivorous of the species examined, eating a large proportion of fruit, or vegetable food, the total amount for some months equaling that of the insect food. The species is evidently fond of grasshoppers, but whether or not there is any direct relation between the character of its tongue and that of its food is not evident.

The Sapsucker (*Sphyrapicus varius*, Pl. I, fig. 12) drills into the maples, birches, mountain ash, and apple trees, and feeds upon the sap as well as upon the insects which are attracted by it. The tongue may be used in two ways: either the fringe of stiff hairs may serve as a brush, to which a considerable quantity of sap would adhere, or it may serve by capillary attraction to guide the sap from the little pits in which it gathers to the front part of the tongue.

The tongue of the Sapsucker is much less extensile than that of any other woodpecker examined, and this lack of extensibility is a characteristic of the tongues of insectivorous birds, such as the swifts and swallows. The spines of the upper surface of the tongue also reach their greatest size in the Sapsucker (*Sphyrapicus*), and spine-clad tongues are another characteristic of insect-eating birds. The insectivorous diet of the Sapsucker is further indicated by the fineness of the backwardly directed spiny processes at the base of the tongue and about the opening of the trachea, their use being apparently to facilitate the passage of food past the larynx.

The direct relation of the modifications of the tongue to the character of the food can perhaps be best appreciated by comparing the figures of the tongue, and particularly the enlarged figures of the tongue tips, with the table giving the summary of the food. It will be seen, too, by further comparison that there is a direct relation between the form of the bill, the tongue, and the number of larvæ eaten. Those species which have bills best adapted for cutting into trees containing larvæ, and tongues most capable of extracting them from their hiding places, eat the most. Thus the Three-toed and Pileated Woodpeckers (*Picoides* and *Ceophlœus*) stand at the head of the list, closely followed by the members of the genus *Dryobates*. At the other extreme is the Sapsucker (*Sphyrapicus varius*), for this species was only once found to have eaten larvæ, and in this instance they were probably not obtained by cutting into wood. It should be noted, as showing the importance of the modifications of the tongue, that the Flicker (*Colaptes*), which has a curved bill, not well adapted to cut into trees after grubs, has, next to the Redhead (*Melanerpes*) and Sapsucker (*Sphyrapicus*), eaten the smallest percentage of larvæ of any species examined.

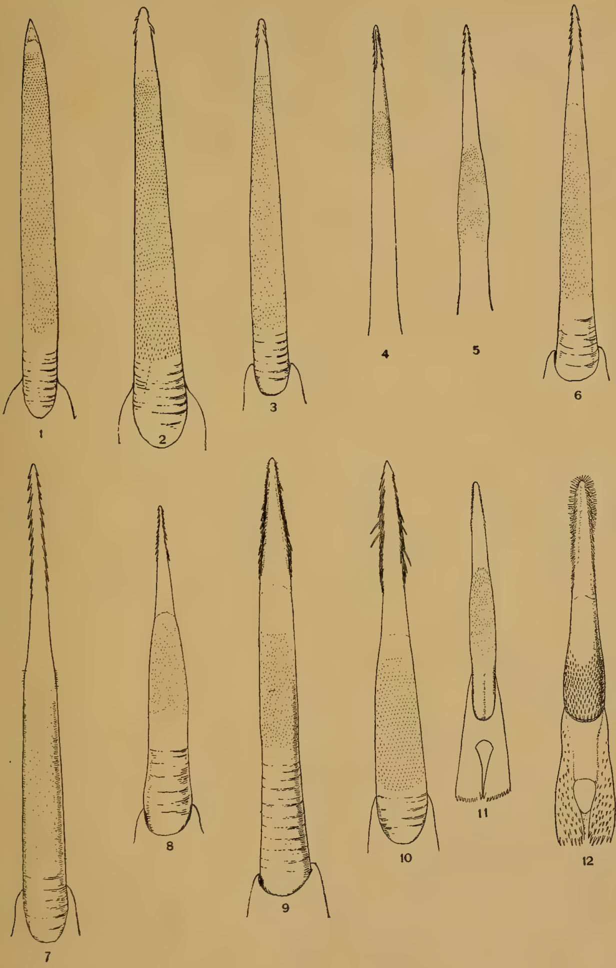
Altogether the evidence favors the view that modifications of the tongue are directly related to the character of the food and are not of value for classification.

PLATE I.

Tongues of North American Woodpeckers (all viewed from above and enlarged 2½ diameters).

Fig. 1. Hybrid Flicker (*Colaptes*). Fort Pierre, S. Dak.
2. Delattre's Woodpecker (*Ceophlœus scapularis*). Tabasco, Mexico.
3. Gilded Flicker (*Colaptes chrysoides*). San Jose del Cabo, Lower California.
4. Downy Woodpecker (*Dryobates pubescens*). Washington, D. C.
5. White-headed Woodpecker (*Xenopicus albolarvatus*). Clarks Fork, Columbia River, Washington.
6. Hairy Woodpecker (*Dryobates villosus*).
7. Gila Woodpecker (*Melanerpes uropygialis*). Fort Huachuca, Ariz.
8. Three-toed Woodpecker (*Picoides arcticus*). Illinois.
9. Red-headed Woodpecker (*Melanerpes erythrocephalus*). Northern Illinois.
10. California Woodpecker (*Melanerpes formicivorous bairdi*). Stockton, Cal.
11. Ladder-back Woodpecker (*Dryobates scalaris*). Matamoras, Mexico.
12. Red-naped Sapsucker (*Sphyrapicus varius nuchalis*). Fort Wingate, N. Mex.

PLATE I.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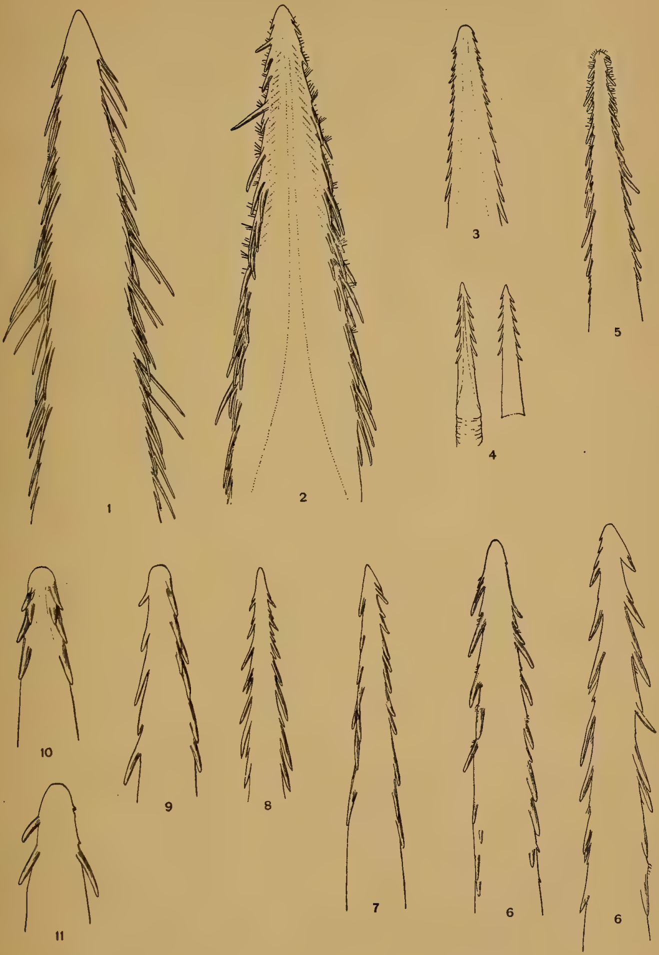
TONGUES OF WOODPECKERS.

Plate II.

Tips of tongues of North American Woodpeckers (all save 4 viewed from above and enlarged 9½ diameters).

Fig. 1. California Woodpecker (*Melanerpes formicivorous bairdi*). Stockton, Cal.
2. Red-headed Woodpecker (*Melanerpes erythrocephalus*). Northern Illinois.
3. Ladder-back Woodpecker (*Dryobates scalaris*). Matamoras, Mexico.
4. Downy Woodpecker (*Dryobates pubescens*). Washington, D. C.
5. Three-toed Woodpecker (*Picoides arcticus*). Illinois.
6. Gila Woodpecker (*Melanerpes uropygialis*). Fort Huachuca, Ariz.
6*a*. Another specimen showing variation due to wear of tongue. San Jose del Cabo, Lower California.
7. Hairy Woodpecker (*Dryobates villosus*).
8. White-headed Woodpecker (*Xenopicus albolarvatus*). Clarks Fork, Columbia River, Washington.
9. Pileated Woodpecker (*Ceophlœus pileatus*). Louisiana.
10. Gilded Flicker (*Colaptes chrysoides*). San Jose del Cabo, Lower California.
11. Delattre's Woodpecker (*Ceophlœus scapularis*). Tabasco, Mexico.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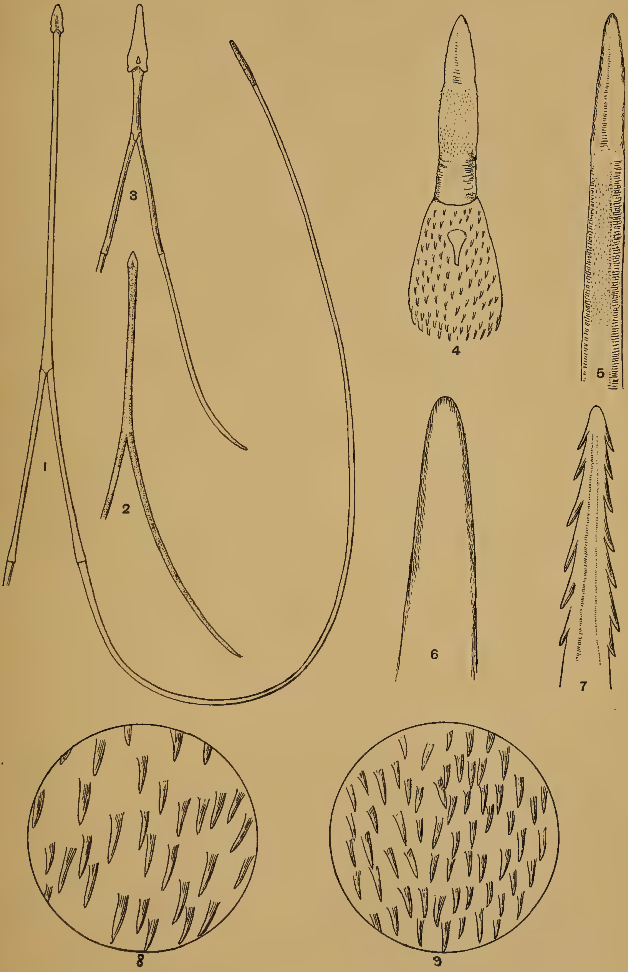
TONGUES OF WOODPECKERS.

PLATE III.

Fig. 1. Hyoid of Flicker (*Colaptes auratus*) (adult, × 2).
2. Hyoid of Flicker (*Colaptes auratus*) (recently hatched, × 2).
3. Hyoid of Red-naped Sapsucker (*Sphyrapicus varius nuchalis*) (× 2).
4. Tongue of recently hatched Downy Woodpecker (*Dryobates pubescens*) (× 4).
5. Tongue of fully-fledged nestling of Downy Woodpecker (*Dryobates pubescens*) (× 3½).
6. Tip of tongue of fully-fledged nestling of Downy Woodpecker (*Dryobates pubescens*) (× 6).
7. Tip of tongue of adult Downy Woodpecker (*Dryobates pubescens*) (× 6⅔).
8. Spines from dorsal tract of tongue of Red-headed Woodpecker (*Melanerpes erythrocephalus*) (greatly enlarged).
9. Spines from dorsal tract of tongue of Ladder-back Woodpecker (*Dryobates scalaris*) (greatly enlarged).



TONGUES OF WOODPECKERS.

Bulletin No. 8

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

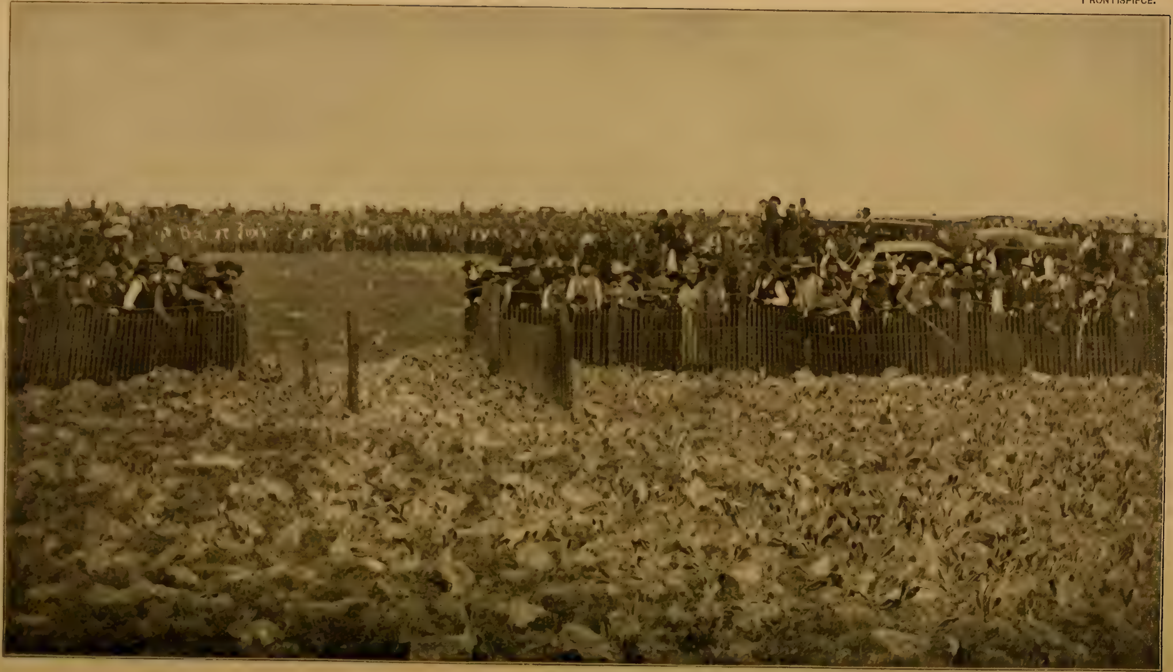
THE JACK RABBITS OF THE UNITED STATES

BY

T. S. PALMER, M. D.
Assistant Chief of Division

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1896



RABBIT DRIVING IN THE SAN JOAQUIN VALLEY, CALIFORNIA. THE GRAND ARMY DRIVE AT FRESNO, MARCH 12, 1892.

(From photograph by Stiffler.)

138.

BULLETIN No. 8

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LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Division of Ornithology and Mammalogy,
Washington, D. C., October 19, 1895.

Sir: I have the honor to transmit and to recommend for publication as Bulletin No. 8 of this division a report on The Jack Rabbits of the United States, by Dr. T. S. Palmer, assistant chief of division. Dr. Palmer has prepared the whole bulletin and is responsible for all statements made, including opinions respecting the status of the various species.

Respectfully,

C. Hart Merriam,
Chief of Division.

Hon. J. Sterling Morton,
Secretary of Agriculture.

PREFACE.

The damage done to crops by rabbits has been illustrated very forcibly during recent years by the losses sustained by farmers and orchardists in the arid regions of the West through the depredations of the large native hares, or jack rabbits. The introduction of irrigation and the cultivation of large tracts of land have favored the increase of rabbits in several States by furnishing a new source of food supply. To such an extent have their depredations increased that the extermination of jack rabbits has become a serious question in California, Colorado, Idaho, Oregon, and Utah.

The objects of this bulletin are: (1) To give a general account of the distribution and habits of the various species found in the United States; (2) to show the methods which have been used to exterminate the animals and to protect crops from their depredations; and (3) to bring together facts and figures concerning the economic uses of rabbits in general, for the purpose of indicating how our native species may be more generally utilized.

The disastrous results of the introduction of the common European rabbit into Australia some thirty years ago are known the world over, and nowhere have the methods of destroying rabbits and protecting crops been so carefully investigated as on that continent. While the Old World rabbit belongs to an entirely different species from the jack rabbits of the West, and differs from them in habits, some of the Australian methods might be used with advantage in our own country. The commercial utilization of rabbits has been attended with considerable success in Australia; large quantities of rabbits are used for food, and an immense number of skins are annually exported to England, some of which find their way to the markets of this country. Therefore, when possible, reference has been made to experiments in Australia which are likely to be of benefit in the United States.

It is obviously impracticable to mention the many persons who have contributed data, but acknowledgments are due to all who have aided in the preparation of this report. The author, however, is under special obligations to Maj. Chas. Bendire and to Messrs. M. S. Featherstone of Goshen, Cal., Henry Lahann of Traver, Cal., Geo. W. Stewart and D. K. Zumwalt of Visalia, Cal., A. Van Deusen of Lamar, Colo., and to Vernon Bailey and J. Ellis McLellan, field agents of the division, for many valuable notes. More than five hundred letters were written in the course of the investigation, and thus a large amount of information has been collected which could not otherwise have been obtained. The statistics given in the last two chapters are only approximate, and necessarily incomplete, but any corrections or additions will be welcomed, particularly in the case of the lists of rabbit drives, which it is desirable to make as complete as possible.

T. S. PALMER.

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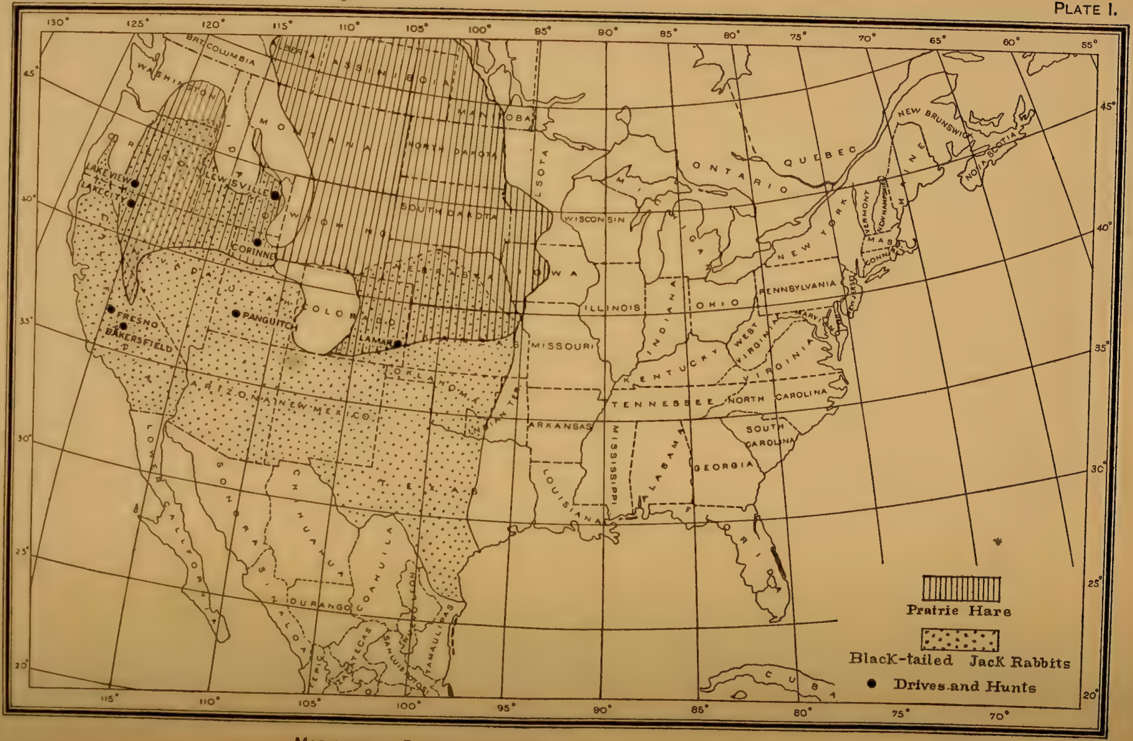
PLATE I.


Prairie Hare
Black-tailed Jack Rabbits
● Drives and Hunts
LAKEVIEW
LAKE CITY
LEWISVILLE
CORINNE
PANGUITCH
FRESNO
BAKERSFIELD
LAMAR
BRIT. COLUMBIA
ALBERTA
ASSINIBOIA
MANITOBA
ONTARIO
QUEBEC
NEW BRUNSWICK
NOVA SCOTIA
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
ARIZONA
NEW MEXICO
COLORADO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
INDIAN TER.
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
MARYLAND
PENNSYLVANIA
NEW JERSEY
NEW YORK
CONN.
MASS.
VERMONT
NEW HAMPSHIRE
MAINE
LOWER CALIFORNIA
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
DURANGO
SINALOA
ZACATECAS
SAN LUIS POTOSI
JALISCO
CUBA
130° 125° 120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65° 60° 55°
45° 40° 35° 30° 25° 20°

MAP SHOWING DISTRIBUTION OF JACK RABBITS IN THE UNITED STATES.

THE JACK RABBITS OF THE UNITED STATES.

By T. S. Palmer, M. D.

CHAPTER I.

INTRODUCTION.

The Great Plains and deserts of the western United States are inhabited by several species of large hares, commonly known as 'jack rabbits.' These rabbits occur almost everywhere, except in the higher mountains and in wooded regions, from the ninety-fifth meridian west to the Pacific, and from the Plains of the Saskatchewan southward over the table-land of Mexico to the Isthmus of Tehuantepec. The resemblance of their large ears to those of the well-known pack animal of the West has suggested the common names of 'jackass hares,' 'jack rabbits,'[1] or 'jacks.' In some parts of California jack rabbits are called 'narrow-gauge mules' and 'small mules,' but fortunately these absurd terms are very local, and not likely to come in general use. In the Southwest and beyond the Rio Grande the large hares are called 'liebres' by the Mexicans, to distinguish them from the cotton-tail rabbits, or 'conejos.'

GENERAL HABITS.

Jack rabbits may be seen abroad at almost any hour of the day, and hence are likely to be recognized by the most casual observer, and are perhaps better known than most other native mammals. Living as they do on the open plain, where they are compelled to rely for safety on quickness of hearing and on speed, their ears and hind legs are developed to an extraordinary degree. This gives them a somewhat grotesque appearance, but in reality few animals are more graceful as they bound along when once thoroughly alarmed. In spite of an unfortunate name and seeming awkwardness of gait, a closer acquaintance with their habits will reveal many points of interest and will arouse admiration for the way in which they seem to overcome every adverse condition of life, so admirably are they adapted to their surroundings.

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[1] This name seems to have been first introduced by Audubon and Bachman in 1851. In referring to one of the species found along the Mexican border they say: "This species is called the jackass rabbit in Texas, owing to the length of its ears." (Quad. N. Am., II, 1851, p. 99); and again, in reference to *Lepus texianus*, "This hare received from the Texans and from our troops in the Mexican war the name of jackass rabbit, in common with *Lepus callotis*." (Ibid., III, p. 157.)

Unlike the cotton-tails, or the common rabbit of Europe, these hares do not live in burrows, but make 'forms' under bushes or in patches of weeds, where they find protection from the weather, and also bring forth their young. Certain shrubs in the West belonging to the genus *Bigelovia* are commonly known as 'rabbit brush,' because they grow in dense thickets, in which rabbits are fond of hiding. Where there are no bushes, the rabbits seek the shade of any objects which can shield them from the burning rays of the sun. A traveler on the Southern Pacific Railroad, crossing the barren plains of the San Joaquin Valley in California, where large stretches of country are devoid of bushes, may sometimes see the jack rabbits crouching in the shadows of the telegraph poles, evidently alarmed by the train, but uncertain whether or not to forsake their shady spots and seek safety in flight.

Extremes of climate apparently do not affect them to any great extent. Some species are at home on the deserts of Arizona and California; others, as the Prairie Hare, contrive to exist in the intense cold of a Montana winter, when the ground is covered with snow, and they are compelled to live on the bark of shrubs or of willows growing along the streams.

Food.—Like other rabbits, they feed almost exclusively on the bark and leaves of shrubs and on herbage, and hardly any land is too poor to supply this food in some form.

On the Great Plains, buffalo and grama grass and such herbs as they can find constitute their principal fare, but this is supplemented in winter by the bark of willows. In the deserts of the Great Basin they seem to be especially fond of the tender annual species of greasewood (*Atriplex*) and several species of cactus. If nothing better is obtainable, however, they can subsist on *Sarcobatus*, and shrubs which other animals seldom touch. Sometimes it is difficult to see where they can obtain sufficient food, but lack of water and of green herbage serve only to reduce their numbers and rarely cause their complete absence from any region. Among the greasewood on the alkali flats northwest of Great Salt Lake, or on the cactus covered deserts of Arizona, the jack rabbits are almost as fat and sleek as when feeding in the alfalfa patches and vineyards of southern California. If necessary they can travel long distances for food, but as they seldom drink, scarcity of water causes them little inconvenience, and the juicy cactus 'pads' or ordinary desert herbage furnish all the moisture necessary to slake their thirst. They are fond of vegetables and alfalfa, and when these can be had they quickly abandon their usual food and establish themselves near the garden or cultivated field. Their fondness for tender bark makes them particularly destructive in the orchard and vineyard, where they are likely to do irreparable injury by girdling young fruit trees and vines.

As jack rabbits multiply rapidly they often become great pests. They have comparatively few natural enemies, and if not held in check by other agencies would doubtless overrun the country. Their undue increase is prevented ordinarily by lack of food, by unfavorable climatic conditions, or by disease. Many die during unusually severe winters; a cold, wet spring is disastrous to the young, and thousands of young and old perish during the epidemics which occasionally break out among them over large sections of country. Nevertheless, they can adapt themselves to circumstances to such an extent as to be able not only to hold their own under most unfavorable conditions, but to increase rapidly whenever food is abundant.

Depredations.—The experience of settlers in the San Joaquin Valley, California, along the Arkansas River in southeastern Colorado, and in southwestern Idaho has shown that where new land has been cultivated or irrigated jack rabbits fairly swarm in from the surrounding country, and instead of being driven out by advancing civilization, at first multiply so enormously that radical measures have to be adopted to protect the crops from destruction.

Some idea of the extent of these injuries can be formed, when it is stated that the damage caused by jack rabbits to the crops in Tulare County, Cal., during a single year has been estimated at $600,000, and one county in Idaho has actually expended more than $30,000 in bounties on these pests! The money spent by individual farmers in the West on rabbit fences and other devices for protecting crops would aggregate a very large sum, which it is impossible even to estimate. But the thousands of rabbits destroyed for bounties and the tens of thousands killed in the large hunts and by epidemics seem to diminish the abundance of the species only in localities where a large part of the land is under cultivation and the animals are systematically killed off year after year.

Jack rabbits are largely used for food and for sport. In a fair race they can outstrip all but the best hounds and can even keep abreast of a railway train running at a moderate speed for some distance. For coursing the native species are considered equal, if not superior, to the Old World hares. Large quantities are shipped to market every year as game, and the trade is capable of considerable increase. The skins might also be saved with profit, but the value of jack rabbits, whether for food or for fur, by no means offsets the immense damage which they do to crops.

SPECIES FOUND IN THE UNITED STATES.

This group of rabbits is unfortunately in a somewhat chaotic condition, and it will be impossible to treat the species satisfactorily until they have been subjected to a thorough revision. A technical discussion of their characters and relationships does not come within the scope of this bulletin, however desirable it might be to consider these questions. For the present it will be sufficient merely to give the species now generally recognized, with the full knowledge that their status and nomenclature are likely to undergo considerable modification in the near future. Such a course is unsatisfactory, but unavoidable under the circumstances.

For convenience, the jack rabbits which occur in the United States may be divided into two groups, according to the color of the upper surface of the tail.[1] In the first group, represented by the Prairie Hare (*Lepus campestris*)—the only jack rabbit which ever turns white in winter—the tail is entirely white. In the second group the upper surface of the tail is marked by a more or less distinct stripe of black. Four or more black-tailed rabbits have been described from the West: (1) A buff-bellied species found in California and southwestern Oregon (*Lepus californicus*); (2) a large, long-limbed species inhabiting southern Arizona and Sonora, known as Allen's Hare (*Lepus alleni*); (3) a widely distributed white-bellied animal with long ears, occurring in the Great Basin and commonly known as the Texan Jack Rabbit (*Lepus texianus*), and (4) the Black-eared Jack, or Eastern Jackass Hare of the Great Plains (*Lepus melanotis*), very closely related to the Texan Hare, but differing from it in possessing shorter ears and richer coloring.

One or more Mexican species cross the southern border of the United States and are found in the extreme southern part of Texas, but their range within our limits is so restricted that they will not be considered further.

Prairie Hare or White-tailed Jack Rabbit.

(*Lepus campestris* Bachman.)

The Prairie Hare was first discovered by Lewis and Clark on their memorable trip across the continent in 1804–1806, although not actually named until 1837.[2] They described it as follows:

> The hare [*Lepus campestris*] on this side of the Rocky Mountains inhabits the great plains of the Columbia. Eastward of those mountains they inhabit the plains of the Missouri. They weigh from 7 to 11 pounds. * * * The head, neck, back, shoulders, thighs, and outer part of the legs are of a lead color; the sides, as they approach the belly become gradually more white; the belly, breast, and inner part of the legs and thighs are white, with a light shade of lead color; the tail is round and bluntly pointed, covered with white, soft, fine fur, not quite so long as on the other parts of the body; the body is covered with a deep, fine, soft, close fur. The colors here described are those which the animal assumes from the middle of April to the middle of November; the rest of the year he is pure white, except the black and reddish-brown of the ears, which never change. A few reddish-brown spots are sometimes intermixed with the white at this season [February 26, 1806] on the head and the upper part of the neck and shoulders. * * * His food is grass and herbs; in winter he feeds much on the bark of several aromatic herbs growing on

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[1] Jack rabbits never turn the tail up like cotton-tails, and hence it is easy to tell at a distance whether the color of the upper surface is black or white.

[2] Bachman, Journ. Acad. Nat. Sci., Philadelphia, Vol. VII, 1837, p. 340.

> the plains. Captain Lewis measured the leaps of this animal, and found them commonly from 18 to 21 feet. They are generally found separate, and are never seen to associate in greater numbers than two or three.[1]

The White-tailed Jack Rabbit has an extended range in the northern part of the Great Basin and on the Great Plains. It is said to be found as far north as latitude 55° in Saskatchewan and ranges eastward to Lake Winnipeg, Elk River, Minnesota, and central Iowa. On the south it is not found on the plains much below central Kansas and southern Colorado—Fort Riley and Pendennis, Kans., and Las Animas, Colo., being near its southern limits. On the Rocky Mountain plateau, however, it goes a little farther south and has been taken at Fort Garland, Colo., and at Kanab, Utah. The Sierra Nevada and Cascade Range mark the limits of its western distribution, but it occurs in the Sierra as far south as Hope Valley (lat. 38° 30′), and probably as far as latitude 36°.

Although called 'Prairie Hare,' it ranges high up in the mountains—at least in summer—higher than any other jack rabbit. In August, 1891, I saw a large rabbit, probably belonging to this species, at an altitude of about 10,000 feet in the Sierra Nevada, about 20 miles south of Mount Whitney. Signs of their presence have been found in the Rocky Mountains far above timber line and nearly to the summits of the higher peaks. It is hardly probable that jack rabbits spend the winter at such altitudes, but the upper limit of their winter range still remains to be ascertained. Abundant food in the mountain meadows and above timber line probably tempts them to ascend from lower levels in summer just as cultivated fields on the plains attract them from a distance.

In the mountains and in the northern part of their range they become pure white in winter, but in Kansas, Nebraska, Washington, and elsewhere near the southern limit of their habitat they undergo only a partial change, or do not turn white at all. In southern Oregon the rabbits inhabiting the higher mountains are said to turn white in winter, while a little lower down they undergo only a partial change and in the valleys do not assume the white pelage.

This species probably never occurs in such numbers as the Black-tailed Jack Rabbit, even under the most favorable circumstances. Dr. Coues speaks of it on the Great Plains as follows:

> Nor is the Prairie Hare in the least gregarious. I have never seen nor heard of several together, and indeed it is rare to find even two together, at any season whatever. It is one of the most solitary animals with which I have become acquainted. * * * I have never found any kind of locality even, which, presenting special attractions, might invite many hares together. All places are alike to them; the oldest frontiersman, probably, could never guess with any degree of certainty where the next hare to bound off before him would appear. If it have any preference, however, it is for 'weedy' tracts, of which the sage-brush regions furnish the best examples; there it finds shelter which the low, crisp, grass of rolling prairie does not afford, and also doubtless secures a greater variety of food.[2]

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[1] Coues' Edition Hist. Exped. Lewis and Clark, Vol. III, 1893, pp 865–866.

[2] Bull. Essex Institute, VII (1875), 1876, pp. 80–81.

Opinions seem to differ as to the abundance of the Prairie Hare, but it is certainly more common in many places than in the localities just described. Dr. A. K. Fisher has seen as many as 20 together near Colby, Kans., and farther north it is killed in large quantities for market. A commission house in St. Paul, Minn., reports having handled about 12,000 jack rabbits during the winter of 1894–95, most of which came from North and South Dakota, where this is the only species. Several thousand are estimated to have been killed in Codington County, S. Dak., alone during the same season. Certainly it must be tolerably abundant in these States to be obtained in such numbers. In the northern part of the Great Basin it is also abundant in certain localities, especially in southern Oregon. Complaints have recently been received from Washington that crops and young orchards near Sunnyside, in the Yakima Valley, have been seriously injured, while near Prescott, Wallawalla County, timber claims planted with black locust trees have been ruined by the White-tailed Jack Rabbit.

Farther south it was met with in considerable numbers by J. K. Lord, during his journey from The Dalles to Walla Walla. In describing the country between the John Day and the Umatilla rivers he says:[1] "As we ride on, I noticed what I at first imagined must be the droppings of a large flock of sheep covering the ground thickly, just as though the animals had been folded. I had barely time to think what animal could be so abundant, when the dogs, tired as they were, started two or three large hares from under the wild sage bushes. We saw numbers of them, and shot several, but the flesh tasted so strongly of the wild sage, on which these hares mainly subsist, that eating it was an impossibility. The Prairie Hare (*Lepus campestris*) appears entirely confined to these sandy desert lands, being replaced by the Red Hare (*L. washingtonii*) in the timbered districts.

"The fur of the Prairie Hare is long and silky, and exactly the color of the sand and the dead leaves under the bushes where they make their 'forms.' Unless they move, it is impossible to distinguish them, although looking down on their backs." But when once startled they are off in an instant, and their characteristic actions at such times are thus described by Dr. Coues:[2]

> The extraordinary agility of this animal, which would be inferred from inspection of its lithe yet muscular and free-limbed shape, has always attracted attention. * * * The first sign one has usually of a hare which has squatted low in hopes of concealment, till its fears force it to fly is a great bound into the air, with lengthened body and erect ears. The instant it touches the ground it is up again, with a peculiar springy jerk, more like the rebounding of an elastic ball than the result of muscular exertion. It does not come fairly down, and gather itself for the next spring, but seems to hold its legs stiffly extended, to touch only its toes, and rebound by the force of its impact. The action is strikingly suggestive of the 'bucking' of a mule, an affair with which people in the West are only too familiar. With a succession of these high jerky leaps the animal makes off generally in a straight

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[1] Naturalist in British Columbia, II, 1866, pp. 95–96.

[2] Bull. Essex Institute, VII (1875), 1876, pp. 83-85.

course; there is nothing of the dodging or scuttling about that marks the running of the smaller rabbits. As it gains on its pursuers, and its fears subside, the springs grow weaker, just as a flat stone 'skipped' on the water diminishes in length of the rebounds, and finally the animal squats in its tracks on its haunches with a jerk, to look and listen. * * * The attitude at such times is highly characteristic. One fore foot is advanced a little before the other, and the ears are held pointing in opposite directions. A hare in such an attitude as this is always upon the watch, and the slightest stimulation of its fears at such a time is enough to start it on its bounding course. It is a beautiful exhibition of timid watchfulness.

I have never seen this hare stand erect with its forepaws off the ground, as some of its smaller relatives are wont to do, and I doubt that it ever assumes this attitude except perhaps momentarily.

California Jack Rabbit.

(*Lepus californicus* Gray.)

The California Hare is one of the most easily recognized of the black-tailed rabbits which inhabit the United States. It is gray above, often tinged with brownish and mixed with black; the lower surface of the body and tail is buff. From the tip of the nose to the end of the tail vertebræ it measures about 23¼ inches (592 mm.). The ears vary from 5 to 6 inches (130–150 mm.), while the tail is only about 4 inches (102 mm.) in length.[1] The only other species which is likely to be confused with it is the Texan Jack Rabbit (*Lepus texianus*), which is also found west of the Sierra Nevada, in the San Joaquin Valley. But while individuals of both species show considerable variation in color according to season, the California Hare is browner and darker above, and the lower surface of the body and tail is buff or tan color, instead of white, as in the Texan species. Both are about the same size, but the tail in the California Jack Rabbit averages about an inch (25 mm.) longer.

Nowhere in the United States, and perhaps nowhere in the world, except in Australia, are rabbits so abundant as in some parts of California, but the published data respecting the distribution of the several species is a good illustration of how much still remains to be learned about even the commonest animals. The California Jack Rabbit was described in 1837, the same year in which the Prairie Hare was named, and the Texan species was first made known in 1848. Although all three of these rabbits have been frequently collected for nearly half a century, and all have been known to occur in California, it is only recently that the limits of their ranges have been accurately determined.

Hitherto it has been the custom to refer all the large black-tailed rabbits found west of the Sierra Nevada to the California species (*Lepus californicus*); but the Death Valley expedition sent out by the Department of Agriculture established the fact that the one best known, on account of its extraordinary abundance, in the lower San Joaquin Valley is not the California Jack Rabbit, but the widely distributed Texan species which occurs in the bottom of the valley from the Tejon Mountains north almost to latitude 38°.

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[1] Average of 10 specimens from northern California.

The true California animal was formerly supposed to extend eastward to the Colorado River and Arizona, but more recent investigations show that it is restricted entirely to the region west of the Sierra. Here, where the chaparral-covered slopes of the foothills dip down to the valleys, it is most at home, mainly below an altitude of 3,000 feet. Rarely does it range above 5,000 feet, although in one instance at least, on Mount Piños, it has been found higher than 8,000 feet. But the individuals found at these higher levels are few in number, and are probably only stragglers which have wandered up from the lower foothills. It avoids the dark, damp forests of the redwood belt on the Northwest coast; but finding suitable localities beyond the limits of its native State, it has crossed the Siskiyou Mountains and taken possession of the Rogue River and Umpqua valleys in Oregon, and is known to range as far north as Comstock, in Douglas County. Mr. Clark P. Streator reports that a single specimen, probably a straggler, was killed near Eugene, at the head of the Willamette Valley, about November 20, 1893. To the south this species extends some distance down the peninsula of Lower California.

While the limits of certain portions of this range are readily understood from well-marked conditions of climate and topography, it is by no means easy to explain the invisible but apparently sharply defined lines which separate the California and Texan rabbits in the great interior valley of California. Here they probably mingle with one another, but at no point are their habitats known to overlap to any great extent. Nor is it clear why the Texan Jack Rabbit, which extends up the east slope of the Sierra as high as 7,000 feet and over Walker pass (altitude 5,300 feet), should occupy only the bottom of the San Joaquin Valley below 2,000 feet. This part of its range is inclosed on both sides by that of *Lepus californicus*, which is here restricted to the foothills, but which spreads out to the north and covers the whole expanse of the Sacramento Valley, as well as the slopes of the Sierra Nevada and Coast Ranges. Briefly stated, the white-bellied species is found in the bottom of the San Joaquin Valley, while the buff-bellied animal occupies the Sacramento Valley and the adjacent foothills, as well as those surrounding the San Joaquin Plains.

The California Jack Rabbit is nowhere as abundant as the Texan species. In some portions of the Coast Range only two or three individuals will be found over a large extent of country, and it is quite rare in some of the valleys southeast of San Franciso Bay; but this is due mainly to the settlement of the country, and the various means adopted for its extermination. It is perhaps most abundant in the Rogue River Valley, Oregon, along the western slope of the central part of the Sierra Nevada, and in the San Gabriel and San Bernardino valleys.

In speaking of the California species T. S. Van Dyke[1] says: "Few animals are more graceful than this hare, whether skimming the

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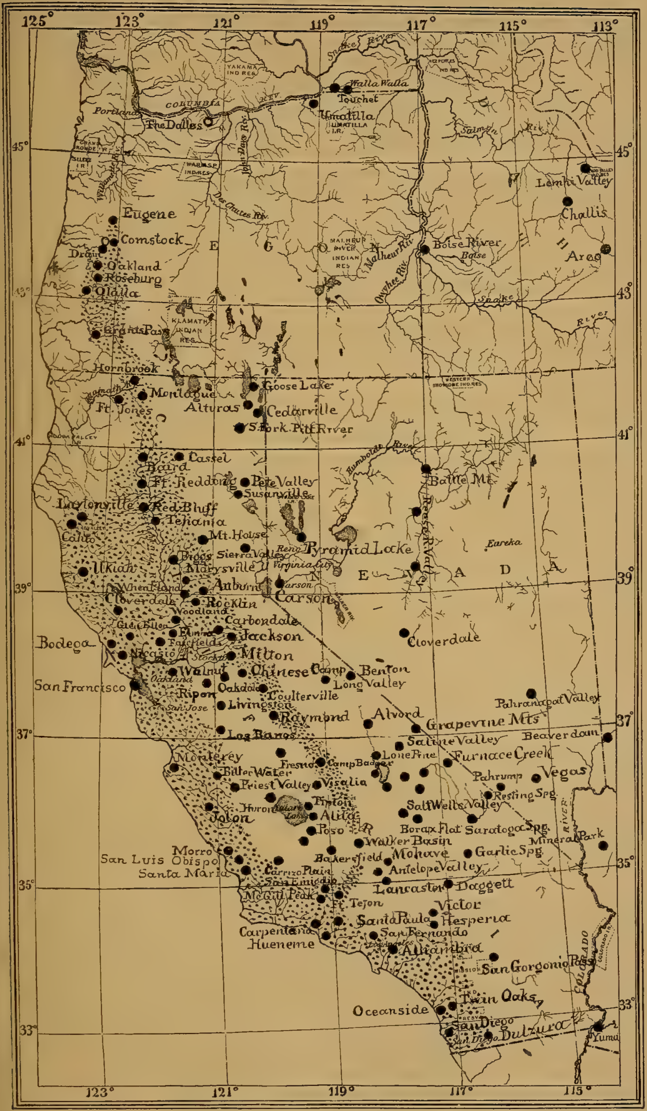
[1] Southern California, 1886, p. 131.



Distribution of California and Texan Jack Rabbits.

Dotted area = California Jack Rabbit; spots outside this area show where the Texan Rabbit has been collected.

plain before the outstretched greyhound or aroused from his 'form' he dashes away with high jumps, as if to take a better view of the intruder, or stopping and rearing upon his hind legs, stands erect, with ears pointed at the zenith and surveys him at safe distance, then again lengthens out his trim form and hugs the ground like a racer until a mile away. Sometimes at early morning or evening you may see him scudding along the plain as if in play, running 2 or 3 miles, perhaps, most of the time at high speed. * * * A fine runner he is, too, and gifted with good staying qualities. It takes a good greyhound to overtake the best of them, while the slowest ones distance a common dog at every bound."

Black-tailed Jack Rabbit, Texan Jack Rabbit.

(*Lepus texianus* Waterhouse.[1])

This hare is pale-gray above, often tinged with brownish and mixed with black; the lower surface of the body and tail is white, while the tips of the ears and upper part of the tail are distinctly marked with black. In length it measures about 25½ inches (647 mm.[2]) from the tip of the nose to the end of the tail vertebræ and weighs 4 or 5 pounds. The ears average 6¾ inches (171 mm.) but the tail is only 4¼ inches (109 mm.) in length. The Black-tailed Hare is smaller than either the Prairie Hare or Allen's Hare, but is about the same size as the California Jack Rabbit. Specimens from southern Arizona are not as large as those from the central part of the Territory and other portions of the Great Basin region, and for this reason have been recently separated by Dr. J. A. Allen[3] as a subspecies or race called the Desert Hare (*Lepus texianus eremicus*).

Usually it is not difficult to distinguish the Black-tailed Hare from other species found in the same region. In the northern parts of its range it occurs along with the Prairie Hare in some parts of Oregon, Washington, Idaho, Colorado, Nebraska, and Kansas, but here the latter (*Lepus campestris*) may be recognized by its white tail, larger size, and more or less complete change of pelage in winter—no black-tailed species showing any tendency to turn white in winter.

The Texan Rabbit will hardly be confused with the larger and longer limbed Allen's Hare in southern Arizona, after they have once been seen together, but it is sometimes difficult to distinguish it from the California Jack. Although typical specimens of the latter are buff instead of white below and have the lower surface of the tail buff, those from the foothills bordering the San Joaquin Valley in California are frequently so light in color as to closely resemble the white-bellied Texan Rabbit.

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[1] Under this name are included all the black-tailed jack rabbits, except *Lepus alleni*, which are found from the Rocky Mountains west to the Sierra Nevada and Cascade Range.

[2] Average of 9 specimens collected by Dr. E. A. Mearns at Fort Verde, Ariz. (Bull. Am. Mus. Nat Hist., II, Feb. 1890, 302.)

[3] Ibid., VI, Dec. 20, 1894, pp. 347-348.

The Black-tailed Jack Rabbit is found in the Great Basin from the Rocky Mountains west to the Cascade Range in Oregon and to the Sierra Nevada in California, and from central Idaho and southeastern Washington south to Mexico. Its range extends eastward into western Texas and some distance down the Rio Grande. West of the Sierra it has a most remarkable distribution in a narrow strip along the bottom of the San Joaquin Valley from the Tejon Mountains nearly as far north as latitude 38°. It gains access to the valley from the Mohave Desert by way of Walker Pass (altitude 5,300 feet) and probably also by the Cañada de las Uvas (altitude 4,300 feet). It is distinctly an animal of the deserts and plains and nowhere ascends to very high altitudes.

In southern Arizona and on the Colorado Desert in California the Texan Jack Rabbit is usually seen singly or in groups of only two or three individuals, while in Kansas, eastern Colorado, and some portions of the Great Basin large numbers are often found together. Its abundance or scarcity is usually governed by local conditions—an unusually cold winter, an epidemic or a dry year in which food is scarce, may so reduce its numbers as to make the species appear rare where ordinarily it is abundant. When food supply or other conditions favor its increase it is gregarious to a high degree, and occurs in immense numbers.

Forty years ago Dr. George Suckley found these rabbits very abundant south of the Boise River, on his trip through southwestern Idaho, in September, 1854.[1] He says: "They are so numerous that our command of 60 men subsisted on them for nearly a week. In a short ride of an hour's duration to see 30 near the trail was nothing remarkable. * * * This hare breeds in great numbers on the vast sage plains at the South Boise River, between it and the Snake River."

More recently, in 1878, Maj. Chas. Bendire found them in immense numbers in the Payette Valley, in southwestern Idaho, where fully 150 were seen together one morning near Payette River Ferry. At this point there was a small grass-covered island to which the rabbits could cross from the river bank by a bridge. When startled they merely loped away for a few yards and then stopped to ascertain the cause of the disturbance. A writer in 'Forest and Stream'[2] states that in the vicinity of Austin, Nev., jack rabbits are exceedingly abundant, and that 487 had been killed in eight hours by a party of 12 hunters.

But the Texan Jack Rabbit is most abundant in the southern part of the San Joaquin Valley from latitude 37° southward, where the conditions for its existence are so favorable that it is still able to hold its ground in spite of the great numbers annually slaughtered by drives.

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[1] Pacific Railroad Reports, XII, Book 2, 1860, Chap. II, p. 105.

[2] Vol. XVIII, Apr. 20, 1882, p. 229.

In the summer of 1891 I saw large numbers just south of the town of Bakersfield. At least a hundred were in sight at once, and were so tame that they paid little attention to teams passing along the road, and would allow a person to approach within a few feet before moving. Dr. A. K. Fisher and Mr. Vernon Bailey also saw thousands of jack rabbits between Bakersfield and Visalia only a few weeks later. At one point just north of Delano, Tulare County, at least 100 scampered away at a single discharge of a gun.

Referring to the habits of the Black-tailed Jack Rabbit in Arizona, Dr. Coues[1] writes:

> At Fort Whipple, the species is very common the year round, and almost every sort of locality is frequented by them, though they chiefly affect grassy meadows and open glades, interspersed with copses, or clumps of oak trees, or patches of briery undergrowth. The gulches, or 'washes,' as they are called, leading out of mountain ravines, and thickly set with grease-wood (*Obione* [*Atriplex*] *canescens*), are favorite resorts. They feed much upon this plant, and by their incessant coursings through patches of it they wear little intersecting avenues, along which they ramble at their leisure. When feeding at their ease, and unsuspicious of danger, they move with a sort of lazy abandon, performing a succession of careless leaps, now nibbling the shrubs overhead, now the grass at their feet. They are *not at all gregarious*, though peculiar attractions may bring many together in the same spot. They do not burrow, but construct a 'form' in which they squat. I do not think these are permanent; but rather that they are extemporized, as wanted, in some convenient bush; though the case may be different during the season of reproduction. It has been stated by some authors, that only two or three are produced at a birth, which I know to be at least not always the case, having found as many as six embryos in the multipartite womb of a pregnant female. In the latitude of Fort Whipple the young are brought forth in June.
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> * * * It has a long, swinging gallop, and performs prodigious leaps, some of them over bushes 4 feet high; now in the air, its feet all drawn together and downstretched; now on the ground, which it touches and rebounds from with marvelous elasticity. It will course thus for a hundred yards or so, and then stop as suddenly as it started; and, sitting erect, its long, wide open ears, vibrating with excitement, are turned in every direction to catch the sound of following danger.

Black-eared Jack Rabbit or Eastern Jackass Hare

(*Lepus melanotis* Mearns.)

The Black-eared Jack Rabbit is simply the eastern form of the Black-tailed Rabbit of the Great Basin region, and was described only six years ago, in 1890, by Dr. E. A. Mearns, from a market specimen supposed to have been killed near Independence, Kans.[2] The differences between it and the common Black-tailed Jack Rabbit are only apparent after a careful comparison of a series of specimens, but *Lepus melanotis* is described as having a richer coloring and shorter ears than its Western representative. Whether it should be recognized as a full species or merely a subspecies need not be considered here; but it may be explained that under this name are included all the black-tailed jack rabbits occurring east of the Rocky Mountains and from central Texas northward to Nebraska.

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[1] Am. Nat., I, Dec., 1867, pp. 532–533.

[2] Bull. Am. Mus. Nat. Hist., N. Y., II, Feb., 1890, pp. 297–300. The average measurements of two specimens from Independence, including the type, are: Total length, 23¼ inches (590^{mm}); tail, 3 inches (77^{mm}); ear, 5½ inches (142^{mm}). The ear averages nearly 30^{mm} shorter than in *L. texianus*.

This hare is found on the Great Plains from eastern Kansas to the Rocky Mountains and western Texas, where its range probably merges into that of *Lepus texianus*. In some parts of Kansas and in southeastern Colorado it is very abundant and is killed in large numbers. When full grown it weighs about 6 pounds and is the black-tailed rabbit most commonly seen in the markets of Eastern cities.

Its habits are similar to those of other jack rabbits. According to Mr. H. P. Attwater it is sometimes captured when young and kept alive, but is always wild and very pugnacious. It is much used in coursing, and is considered one of the best rabbits for this sport. An interesting experiment on its speed was made on the plains of eastern Colorado near Burlington, about 160 miles east of Denver.[1] Several hares were turned loose after having a drop or two of anise-seed oil rubbed on their feet, and as soon as they were out of sight a pack of five hounds was started in pursuit. The first and second hares were run down in about twenty minutes, but the hounds required nearly two hours to overhaul the third, 'an old black tail.' The writer adds that these rabbits run in circles as a rule. They make a spurt for the first two miles, but then begin to weaken, and if the scent is not lost they are certain to be overtaken by the hounds at last.

Allen's Jack Rabbit.

(*Lepus alleni* Mearns.)

Allen's Jack Rabbit is the largest and finest of the hares of the Southwest. Even at a distance it may be readily distinguished by its gray sides and the white on the hind part of the body. Its length is about 25¼ inches (643^{mm}); tail, 2¾ inches (69^{mm}); while the ears measure about 7¾ inches (195^{mm}).[2] The color above is yellowish brown mixed with black, but this area is restricted by the gray of the sides, and in autumn (November) specimens is a beautiful dark steel gray. This species was also described by Dr. E. A. Mearns, in 1890[3] from a specimen collected May 8, 1885, at Rillito Station, on the line of the Southern Pacific Railroad near Tucson, Ariz.

Allen's Hare is found in the deserts of southern Arizona and Sonora, in the region extending from Phœnix southeastward to the Santa Catalina and Santa Rita mountains, and thence south into Mexico almost as far as Guaymas. It has been collected in Sonora at Oputo, on the upper Yaqui River, at Magdalena, Hermosillo, and Ortiz, and probably ranges over the greater part of the State. Little is known as to the western limits of its range, or the injury which it may do to crops when the country becomes more thickly settled. Concerning its habits Mr. W. W. Price says:

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[1] Am. Field, XLII, July 21, 1894, p. 53.

[2] Average of three specimens, including the type, collected by Dr. Mearns.

[3] Bull. Am. Mus. Nat. Hist., II, Feb. 1890, 294–297, 300.

"This splendid hare is abundant about Tucson and in lower portions of the desert belt. It is found both on the gravelly hills bordering the Rillito at Fort Lowell, and on the immense mesquite and *Larrea* plains of Tucson. It is somewhat shy, and hard to secure, except with a rifle. One rarely comes upon it suddenly. I have never seen it start up with the quick, rapid flight of *L. texianus.* It has a slow, apparently awkward gait, but its leaps are long, and it gets over the ground with surprising rapidity. In color and habits it is so very different from any other American hare, the wonder is that it should have so long remained undescribed."[1]

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[1] Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 201–202.

CHAPTER II.

ABUNDANCE AND RAPIDITY OF INCREASE.

It is well known that jack rabbits are very prolific, and reference has already been made to the great numbers found together in some parts of California, Idaho, Nevada, and South Dakota. Similar instances might be mentioned for southeastern Colorado and central Utah. But the best illustrations of extraordinary abundance in limited areas can perhaps be found in California. In Modoc County, in the northern part of the State, nearly 25,000 jack rabbits were said to have been killed in three months on a tract of land only 6 by 8 miles in extent; this was during the period when the bounty law was in force. A still more remarkable case has been recorded in the San Joaquin Valley. Some of the early drives near Bakersfield took place on a ranch less than 1 square mile in extent. In the first drive, on the afternoon of January 2, 1888, 1,126 rabbits were killed; as soon as the animals were dispatched, the same field was passed over again and 796 more killed. A week later, on January 10, there were two drives on the same ground, the first resulting in the destruction of 2,000 rabbits, the second in more than 3,000; in the latter an adjoining field was also driven over. It was estimated that altogether about 8,000 rabbits were killed on this ranch in nine days. The 'Kern County Echo' of March (8 ?), 1888, stated that a total of about 40,000 rabbits had been killed in the drives about Bakersfield from January 1, 1888, up to that date, and referred to an estimate that two-thirds of the rabbits killed in the drives were females and the average number of young of each of these was 3½. On this basis it was computed that had these 40,000 rabbits lived two months they would have increased to 135,000. When it is considered how much injury a single rabbit can do, the damage which such an army of rabbits is capable of inflicting would hardly be less than that caused by a grasshopper plague.

Surprise is sometimes expressed that jack rabbits are not entirely exterminated in regions where they have been mercilessly slaughtered for years, and it might be supposed that animals which live on the open plains without even the protection afforded by burrows or holes of any kind, could easily be kept within bounds, though they have comparatively few natural enemies. But experience has shown that this is no easy matter. Ada County, Idaho, which has been systematically killing off the jacks for fifteen years under the bounty system, received more scalps and expended more money for this purpose during 1895 than in any year since the bounty law first went into effect in 1878.

In view of these facts it may be worth while, before considering the subject of depredations or the methods used in extermination, to dwell somewhat on the way in which these rabbits contrive to hold their own under apparently great disadvantages and when exposed to attacks of every kind. Naturally their breeding habits and the rate at which the animals increase should be considered in this connection.

BREEDING HABITS.

The breeding habits of the Old World hare and rabbit are well known and have been determined repeatedly by observations on animals kept in confinement, so that the period of gestation, the number of young in a litter, the number of litters born in a year, and the age at which each species begins to breed are known with considerable accuracy. According to Sir Richard Owen, the period of gestation in the Old World hare (*Lepus timidus*) and the rabbit (*Lepus cuniculus*) varies from thirty to thirty-one days, and it is probably much the same in the case of our native species. The common European rabbit breeds from four to eight times a year and the number of young varies from 3 to 8 in each litter; it begins to breed when only 6 months old and attains an age of 7 or 8 years.[1]

The breeding habits of the various jack rabbits are so much alike that the account of those of any one species will serve as an illustration of the others. The following description is taken from Dr. Coues' paper on the Prairie Hare in Montana, to which reference has already been made:

> In the regions where I have studied this hare, the female brings forth in June and early July—oftener the latter—and apparently only one litter is produced each season. The number of young is 5 or 6, as a rule. The form is simply constructed, without burrowing, in the grass beneath some low, thick bush or tuft of weeds. The young are said to suckle and follow the mother for a month or more. They are agile little creatures, even when only a week or two old, and it is only when very young that they can be caught by hand. In traveling along the Milk River (where the species was abundant), early in July, I had several little ones brought to me, and some I kept for a time in a box. * * * Though only 5 or 6 inches long, they had all the motions and attitudes characteristic of the parents, and made shift to run about quite cleverly. They could not eat, but some of them could be coaxed to lick a little milk. (Bull. Essex Inst., VII, 1875, p. 81.)

Much still remains to be learned in regard to the number of young per annum, the exact time when they are born and particularly the number of litters per year. The interest in this subject is not restricted to the naturalist, for it is a matter of practical importance to the orchardist or the farmer to know when his efforts at extermination will be most effective.

Number of young in a litter.—Compared with the domesticated rabbit the jack rabbit does not increase very rapidly. Writers, however, differ widely concerning the number of young and the frequency with which the different species breed. Most of the statements seem to be largely matters of opinion. Mr. H. P. Attwater states that the jack rabbit on the southeastern coast of Texas is supposed to have only *one* young at a birth. Dr. J. H. Clark, surgeon of the Mexican Boundary Survey, notes that the species found along the Mexican border brings forth but 2 or 3 young at a time, and these usually late in the summer. The writer, in the 'Kern County Echo,' referred to above, says: "If these rabbits breed every six weeks, as is asserted by many, or at the outside, three times a year, * * * every farmer in this end of the valley without a rabbit-tight fence will be compelled to surrender his ranch to the pests."

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[1] Flower & Lydekker, Mammals Living and Extinct, 1891, p. 494.

As very little positive data seems to have been given by most observers, recourse was had to the specimens in the collections of Dr. C. Hart Merriam, the United States Department of Agriculture, and the American Museum of Natural History,[1] to supplement the few published notes. Altogether about 50 specimens were available for this purpose, consisting first of 15 adult females with young, which had been examined in the field and a note made of the number of embryos which each contained. These furnish the most accurate data possible concerning the number of young. The other specimens, 36 in number, comprise rabbits less than half grown, and in some cases only a few days old, which may be utilized to show roughly the dates of birth. The data thus collected are shown in the following tables:

Table showing number of Jack Rabbits in a litter (based on dissection of females with young).

Species.	Number of embryos.	Date.	Locality.
Lepus californicus	4	Mar. 19, 1894	Jolon, Cal.
Lepus campestris	4	May 5, 1890	Bridger Pass, Wyoming.
Do	4	May 30, 1894	Forks of Cheyenne, South Dakota.
Lepus melanotis (?)*	1	Dec. 28, 1894	San Antonio, Tex.
Lepus texianus	1	Jan. 24, 1891	Death Valley, Cal.
Do	6	Mar. 25, 1891	Do.
Do	6	Apr. 16, 1891	Panamint Mountains, Cal.
Do	4	May 1, 1891	Salt Wells Valley, Cal.
Do (?)	4	May 8, 1893	Raymond, Cal.
Do (?)	3	May 9, 1893	Do.
Do	2	May 25, 1892	Fort Huachuca, Ariz.
Do	6	June ? ——	Fort Whipple, Ariz. (Coues).
Do	3	July 9, 1890	Blackfoot, Idaho.
Do	3	July 31, 1891	25 miles west of Benton, Cal.
Do	2	Sept. 5, 1889	San Francisco Mountain, Arizona.

* Specimen in American Museum of Natural History, New York.

The number of young as shown by these 15 specimens varies from 1 to 6—never more; in fact it is probable that 6 is rather exceptional, although found in three of the cases mentioned above. The average obtained from the table is between 3 and 4 (3.5), but this result is probably not accurate. It will be noticed that all the cases of 3 young or less are in the desert region of the Great Basin or Arizona, or else represent second or third litters. Dr. E. A. Mearns, United States Army, who has examined many specimens in Arizona, states that it is very common to find only 1 young and that 2 is the usual number in that region. Farther north, however, both in the case of the Prairie Hare and the California Jack, 4 is probably not too high an average for the first litter, but it is doubtless true that later in the season the litters are smaller.

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[1] Through the kindness of Dr. J. A. Allen, curator of mammals in the American Museum of Natural History, New York, I have had an opportunity of examining the jack rabbits in that collection.

Time of birth.—The evidence at hand not only fails to substantiate the view that jack rabbits breed every six weeks in the year, but there is every reason to believe that each species has a regular breeding season and a definite period of rest. Certainly no data have been found which show that the young are born in the United States in October, November, or December. It is almost impossible to determine the exact dates of birth unless the animals are kept in captivity, but the time can be estimated approximately. As already stated, the period of gestation is about thirty days, so that the specimens mentioned in the last table can be utilized for this purpose by *adding* thirty days to the dates given and the results will be within a month, and probably within two or three weeks of the true time. Furthermore, it may be assumed that jack rabbits attain their full size (but not weight) in about two months, and the size of the adults and of the young at birth being known, the measurements of a young animal may be taken as a rough index of its age. The following table is based on an examination of 36 young rabbits selected for this purpose. No specimens were included which seemed to be much more than half grown, and nearly all those given may be assumed to be less than thirty days old and hence the date of birth less than a month earlier in each case.

The collection contains several specimens which illustrate the size and condition of the young at birth. Perhaps the most interesting are 4 fœtal Prairie Hares collected at Bridger Pass, Wyoming, May 5, 1890, evidently but a day or two before birth. The average measurements of these specimens are: Total length, 149^{mm}; hind foot, 36^{mm}. The animals are entirely covered with hair and the eyes are open. In one, at least, the front teeth (incisors) are cut, and nearly all the molars in the upper jaw are just breaking through the gums. The specimens having been preserved in alcohol for four years are somewhat shrunken and the total length is probably about 25^{mm} too short. A specimen of the Black-tailed Rabbit (*Lepus texianus*) from Panamint Valley, California, collected January 10, 1891—evidently only a few days old—measures only 192^{mm} in length, and hind foot 47^{mm}. Another of about the same age from Santa Rosalia, Chihuahua, taken September 21, 1893, measures 185^{mm}, hind foot, 43^{mm}. Thus, the young at birth average a little less than 200^{mm} in length; the hind foot about 40 or 45^{mm}. The dates of birth can be approximated from the following table with sufficient accuracy for present purposes by comparing the difference between these measurements and those of any particular specimen with the difference obtained by subtracting the measurements of the young from those of the adult of that species.

List of young Jack Rabbits, showing time of birth.

Species.	Date.	Locality.	Total length.	Hind foot.	Remarks.
			Mm.	*Mm.*	
Lepus alleni	June 12, 1892	Rillito Creek, Arizona	455	110	Adult: Length 643^{mm}; hind foot, 138.
Lepus californicus	Mar. 18, 1892	San Fernando, Cal	375	105	Adult: Length 592^{mm}; hind foot, 136.
Do	Mar. 23, 1894	Jackson, Cal	405	104	
Do	Apr. 15, 1894	Oakdale, Cal	390	87	
Do	Apr. 18, 1894	Chinese Camp, Cal	420	108	
Do	May 1, 1894	Priest Valley, Cal	410	116	
Lepus campestris	May 23, 1894	Newcastle, Wyo	344	95	Adult:‡ Length 598^{mm}; hind foot, 150^{mm}.
Do	May 24, 1894	.....do	350	99	
Do*	May 28, 1888	Fort Pierre, S. Dak	460	105	
Do*	.....do	.....do	445	103	
Do*	Sept. 10, 1887	Fort Buford, N. Dak	265	......	
Lepus melanotis†	Mar. 4, ——	San Antonio, Tex	......	......	One-third grown (?).
Do*	Mar. 9, 1891	Onaga, Kans	......	......	Adult: Length 590^{mm}; hind foot, 130.
Do†	Apr. 12, ——	San Antonio, Tex	266	73	
Do†	July 6, ——	....do	......	......	
Do	Apr. 26, 1894	Vernon, Tex	206	46	
Do	July 30, 1892	Cairo, Kans	405	109	
Do	Sept. 3, 1890	Onaga, Kans	......	......	
Do†	Sept. 17, ——	San Antonio, Tex	......	......	Unborn (?).
Do†	Sept. 17, ——	.....do	......	......	Do.
Do†	Oct. 11, ——	.....do	......	......	Few days old.
Lepus texianus	Jan. 10, 1891	Panamint Valley, Cal	192	47	Adult: Length 647^{mm}; hind foot, 145.
Do	Mar. 27, 1891	Grapevine Mountains, Nev	379	98	
Do	Apr. 10, 1891	Furnace Creek, Cal	200	51	
Do	Apr. 27, 1892	Fort Huachuca, Ariz	380	100	
Do	May 9, 1891	Beaverdam, Ariz	300	88	
Do	May 18, 1889	Phœnix, Ariz	410	102	
Do	May 22, 1889	Carson, Nev	......	109	
Do	June 11, 1891	Lone Pine, Cal	295	84	
Do	July 17, 1894	South Fork, Pitt River, Cal	281	77	
Do	July 26, 1890	Arco, Idaho	240	65	
Do	Sept. 21, 1893	Santa Rosalia, Chihuahua	185	43	
Lepus sp (?)	Jan. 23, 1892	Matagorda, Tex	260	80	
Do†	Sept. 30, 1893	Rockport, Tex	......	......	One-third grown (?).
Do	Aug. 14, 1892	San Luis Potosi, Mexico	195	48	
Do	.....do	.....do	198	48	

* In Merriam collection. † In American Museum of Natural History, New York.
‡ Average of 6 specimens from Wyoming.

It would have been desirable to have a much larger number of specimens, but the localities and seasons are well distributed and compensate in a measure for the small series. The earliest date of birth indicated in these tables is about the beginning of January in the case of three specimens—one taken in Panamint Valley, in the desert region of southern California, the others in southern Texas, at San Antonio and Matagorda. The latest dates (September), are represented by specimens from San Francisco Mountain, Ariz.; Santa Rosalia, Chihuahua, and Rockport and San Antonio, Tex. Between these extremes every month is represented, but most of the young seem to be born in April, May, and June. Specimens born after the 1st of July are from the northern part of the Plains, from the Great Basin, from southern Texas, from elevated regions, or from the table-land of Mexico. There is a noticeable absence of data from the low deserts of southern Arizona and southern California, apparently indicating at least a partial period of rest during the hot, dry summer. The tables also fail to show that any jack rabbits are born before the 1st of February in California west of the Sierra, or before the 1st of April north of Kansas and central Nevada. The length of the breeding season in southern regions indicates that several litters are born each year, but in the northern United States the number is probably not more than two, or at the most, three.

The practical bearing of these generalizations is obvious. Drives or hunts organized for the extermination of rabbits should take place before the beginning of the breeding season, if they are to accomplish the desired end. Just after the young are born the rabbit population in a given place may be two or three times what it was six weeks previous, and the killing of 1,000 rabbits then would be only one-half or one-third as effective as the destruction of an equal number earlier in the season, when all the animals were adults. Drives in southern California should therefore be made in December, January, February, or early in March—the earlier the better, if the weather is favorable; later in the season more rabbits may be killed at one time, but a certain proportion will be young. In Colorado and Utah, hunts made before the 1st of February will accomplish much more than those in April, while in Idaho they may be postponed somewhat later.

Similarly, when killed for game, the rabbits from southern California or Arizona are not likely to be in the best condition after the 1st of February or March, while those from the northern Plains may be shipped up to the 1st of April. On the other hand, the young will hardly be in condition for market before October except in southern regions, and there the hot weather is likely to interfere with their shipment.

CHAPTER III.

INJURY TO CROPS AND MEANS OF PROTECTION.

INJURY TO GRAIN, ORCHARDS, ETC.

With the settlement of the West the jack rabbit has found that several cultivated crops furnish food which is better and more easily obtained than the wild plants on which it formerly fed, a fact that is too often demonstrated by the ravages committed in orchards and vineyards. Like the cottontail, it seldom ignores a neighboring alfalfa field or vegetable garden, and if unmolested can do a surprising amount of damage. Melons, cabbage, carrots, alfalfa, cotton, sweet-potato vines, young grain, grapevines, and trees suffer most frequently from its visits. The damage is most severe, however, in the young orchard set in newly broken ground, for here, deprived of its ordinary food by the cultivation of the land, the rabbit is forced to seek a new supply, and finds it in the tender bark of the young trees. A single animal can girdle a large number of trees in a short time, and will often injure them so seriously that part of the orchard has to be replanted. It destroys both the foliage and bark of young vines, but is especially partial to alfalfa and to cabbages. Fortunately, it does not burrow to any great extent, and therefore does not injure the roots of trees or plants, like the pocket gopher.

It has been estimated that five jack rabbits consume as much food as one sheep; thus some idea can be formed of the damage which a few rabbits may do in the course of a single night. Complaints of their ravages have been received from numerous correspondents from Texas to Washington, and from Kansas to California. Probably all the species are injurious, although no positive evidence against Allen's Rabbit is now at hand, simply because so little land in the area which it inhabits happens to be under cultivation. Most of the injury is done by the California Jack Rabbit and the wide-ranging Texan Hare (*Lepus texianus*).

Mr. H. P. Attwater states that jack rabbits are common in Aransas County, Tex., along the Gulf coast, and do so much damage that many of the smaller truck farms are protected by rabbit-proof fences. In the northern part of the same State Mr. W. J. Crowley, of Grapevine, Tarrant County, reports that they cause considerable injury to grain, and in fields of wheat, oats, and cotton often cut paths 12 inches wide and 300 or 400 yards in length, and destroy patches as large as an ordinary sized room. Mr. A. Vogt wrote from Willow Point, in the neighboring county of Wise, under date of December 6, 1889: "The damage done to my old orchard of a thousand peach trees by rabbits [*Lepus sylvaticus* and *L. melanotis*] is 50 per cent. Three hundred trees are barked all around and below the bud, so that if they come out again they will be seedlings. Whitewashing the trunks does no good, as the rabbits take the whitewash and bark together."

When irrigation was first begun near Lamar, in southeastern Colorado, the rabbits were attracted from the surrounding country, and caused much damage in the alfalfa and young orchards. Hunts were arranged on a large scale to kill off the pests, and proved so successful that regular 'rabbit days' have been celebrated for the last two or three years at Las Animas and at Lamar.

In Idaho much difficulty has been experienced with jack rabbits at the experiment station at Nampa, Canyon County. They are particularly destructive to oats, wheat, barley, clover, vegetables, and fruit trees. Mr. T. T. Rutledge, assistant director, states that entire crops of grain and alfalfa are sometimes destroyed if small in acreage and unprotected.

Mr. J. B. Cure, of Rudy, Fremont County, writes under date of September 10, 1895: "Jack rabbits have done a great deal of damage in this part of the country to grain and lucern, and are increasing very fast. * * * Some of the farmers have lost from 8 to 10 acres of grain by rabbits this season."

Complaints have also been received from the State of Washington from Sunnyside, Yakima County; from Davenport, Lincoln County, and from Prescott, Wallawalla County. Mr. Conrod, of Davenport, wrote on December 19, 1887, that the jack rabbits were causing serious injury to grain, apple and plum trees, raspberry vines, carrots, and cabbage.

Mr. Oscar N. Wheeler, of Prescott, writing under date of August 12, 1895, says: "Jack rabbits (white tailed) have done a vast amount of damage to orchards, vineyards, and grain fields, but are not nearly so numerous now as they were three or four years ago, when they destroyed bearing orchards. Timber claims, planted in black locust that were large and old enough to 'prove up' on, were destroyed by them. People who had hay stacked had to fence it to keep them off. I have known large stacks of hay destroyed by them."

In Utah, Mr. W. G. Nowers wrote in February, 1887, concerning the Black-tailed Jack Rabbit (*Lepus texianus*) in Beaver County: "At times its ravages are enormous; sweeping down from the bench lands and sage plains in myriads, it devours entire fields of cereals. Last year in this and adjoining counties on either side its depredations amounted to several thousand dollars. Last year some farmers in this county lost their entire crop of small grain from this source alone. At Minersville not more than one-third of the crop was harvested; at Adamsville nearly the total crop was taken; at Greenville one-half of the crop was destroyed; and here (Beaver) about the same. This is also a fair representation of the ravages in Iron County south of us."

In California jack rabbits are most abundant on some of the richest lands in the State, and they have been particularly injurious to the vineyards and crops in the southern coast counties and in the San Joaquin Valley. The following account of their ravages in western Fresno County, by Mr. Alvah A. Eaton, gives some idea of the extraordinary numbers in the central part of the San Joaquin Valley, and shows how a scanty food supply drives the rabbits to the cultivated fields. Mr. Eaton says:

> I arrived in Fresno, Cal., April 1, 1890, after what was known as a wet year, i. e., rain enough had fallen to sprout wheat and raise a fair crop without irrigation. These conditions were favorable for various 'tar' and 'alkali' weeds (species of *Madia*) which grew so luxuriantly that year that they prevented the heading of wheat in several sections of the Riverdale country. The next year was dry, and there was no wild feed that the rabbits could get, so they flocked to the wheat fields, feeding on the wheat and hiding and breeding in the weeds. Many were destroyed by burning the weeds, and by gunners, but it did not seem to make much difference. To make matters worse, there had been a bounty of $5 a scalp placed on coyotes, and these were mercilessly hunted, and the rabbits and squirrels throve in consequence.
>
> During the summer of 1891 it was no uncommon thing to start 1,000 rabbits out of a patch of weeds, and in one patch about a quarter of a mile long there were at least 5,000. The winter of 1891–92 was also 'dry,' no feed springing up till late in February. The rabbits were driven by hunger to the alfalfa fields. They gnawed the tops of the stools to the roots, and even dug them out with their feet and ate them. One 10-acre field of my brother's was more thickly covered with their droppings than I ever saw a pasture covered with those of sheep.

Such was the state of affairs in the spring of 1892 just previous to the four great Fresno County 'drives,' which occurred in February and March, resulting in the destruction of more than 43,000 rabbits.

The damage which jack rabbits have done has been enormous, but it is very difficult to obtain reliable statistics. The 'Visalia Delta' of February 16, 1888, estimated that the annual loss in Tulare County amounted to more than $600,000. During the last six or seven years, however, owing to the increased acreage under cultivation and the vigor with which 'drives' have been conducted, the rabbits have been kept pretty well in check.

The loss on account of the depredations of rabbits in Victoria, Australia, for the ten years, 1878–1888, has been estimated at about $15,000,000 (£3,000,000).[1]

PROTECTION OF ORCHARDS AND CROPS.

The cost of properly protecting trees and vines is often a large item in the expense of setting a new orchard or vineyard. Several methods are commonly employed, but the one which is most effective, and the only one which can be used for crops of all kinds, is the rabbit proof fence. Rabbits which succeed in getting into the inclosure may be shot or poisoned.

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[1] Journ. Soc. Arts, London, XXXVII, No. 1879, Nov. 23, 1888, p. 22.

FENCES.

If the orchard or field is to be protected as a whole, it should be inclosed by a low fence so built as to leave no holes large enough to admit a rabbit. While the animals could easily leap over a low fence they are not likely to under ordinary circumstances.[1] In southern California experience has shown that a fence about 2 feet high affords ample protection under ordinary circumstances, and many vineyards and orchards are surrounded by lath fences 2 to 2½ feet in height. In the rabbit-infested region near Bakersfield, Cal., the fences are built somewhat higher than usual—about 5 feet—and are made of laths securely fastened with wire, which is stretched between posts set 15 or 20 feet apart (see corral in Pl. III, p. 47). Several kinds are in use, but in any case the fence should be built well down to the ground, and may be still further protected by running a barbed wire along the surface of the ground, or by turning a furrow against the bottom to prevent the animals from crawling under. A horizontal board fence may be rendered rabbit proof by nailing slats between the boards or by placing the lower boards closer together. Fencing material consisting of laths interwoven with wire is sold in large rolls and can be had in some localities ready for stringing to the posts. Woven wire fences are also made especially for keeping out rabbits. One of the best fences is made of galvanized wire netting with 1½-inch meshes stretched between posts which are set in the ground at convenient distances. The netting should be fastened with staples on the *inside* of the posts, and two barbed wires, with barbs 2½ inches apart, fastened to the *outside* of the posts, one just clearing the ground and the other an inch above the top of the netting. The barbed wires will tear any rabbit that tries to scratch under or jump over the fence. If desirable, a third wire may be stretched a foot or two above the top of the netting, which will make a fence high enough to keep out cattle.[2]

In regions having a heavy snowfall it may be necessary to build the fences somewhat higher, as the rabbits, taking advantage of the drifts, can oftentimes clear a low fence. This difficulty has been experienced in Idaho, and some orchardists have used a combination fence made of paling 4 feet high protected at the bottom outside by a strip of wire netting 2 feet in width. Ordinary fences made of laths or paling can not be relied on if wide spaces are left between the slats, as the rabbits can then gnaw a hole large enough to gain entrance to the inclosure. Prof. Charles P. Fox, director of the experiment station at Moscow, Idaho, suggests that such fences can be still further protected by dipping the slats in a warm solution of silicate of soda or protecting them with sand paint. He also reports that a substitute for fencing is now being tried at the substation at Nampa, Idaho. Rabbits are very troublesome at this place, and in past years have destroyed almost the entire crop of alfalfa. Last spring, instead of building an expensive rabbit-proof fence, a band of alfalfa 30 feet in width was sowed around the field, which was inclosed simply with three strings of barbed wire, the idea being that jack rabbits, which usually feed around the edges of the field, will obtain sufficient food from the outside strip and not molest that within the fence. He says "we can grow rabbit feed in the form of alfalfa cheaper than anything else."

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[1] It may be interesting to note that a jack rabbit has been seen to clear a 7-foot fence at a single leap. Mr. Charles Payne, of Wichita, Kans., had several animals confined in an inclosure of this height and actually saw one or more escape by jumping over the fence. (Am. Field, XLII, Sept. 29, 1894, p. 295.)

[2] Wickson, California Fruits, 1889, p. 553; 2d ed., 1891, p. 577.

In Australia fences have proved the best means of protection, and many miles of rabbit fences have been built by the government. One fence, running from Narromine, on the Macquarie River, to Bourke, on the Darling River, and thence to Barringun, is 291 miles in length and cost on an average £82 per mile. It has recently been extended to Corowa, making the total length 703 miles. Another fence has been built from the Murray River northward along the western boundary of New South Wales for a distance of nearly 346 miles, at an average cost of a little over £75 per mile. These fences were built of 17-gauge wire netting 42 inches in width and having 1¼ or 1½ inch meshes. The fences are looked after by 'boundary riders,' who live in huts about 30 miles apart. Altogether the government has erected 1,049 miles of fencing in New South Wales, while the amount built by individuals has been estimated at about 15,000 miles.[1]

In Queensland about 675 miles of fences have been built by the government[2] and in New Zealand £12,530 have been expended for the South Canterbury fence.

PROTECTION OF SINGLE TREES.

Where the expense of a fence is too great, young trees may be protected by wrapping the stems with strips of burlap, gunny sacking, or coarse cloth an inch or two wide. These strips should be securely tied at the top and bottom. Small cylinders of wire netting, heavy pasteboard, or other material are sometimes used, and a device known as the 'tule-tree protector,' made of the dried rushes or tules, which grow so abundantly in the San Joaquin River swamps in California, has been patented for this express purpose. Recently cylinders made of thin strips of yucca wood (*Yucca arborescens*), with the edges fastened together by wire, have been placed on the market. They come in several sizes and are readily put in position. While they shield the stems from the sun their value in protecting the trees from jack rabbits is open to question.

SMEARS.

Some orchardists advocate painting the trunks of the trees with mixtures distasteful to rabbits. Whitewashing is said to prove effective in some cases, particularly if a mixture of glue and copperas is added to the solution. The mixture is made as follows: Take a bushel of unslaked lime and add sufficient water, then add two pounds of dissolved glue, and stir in thoroughly one pound of copperas. Another mixture which is said to work well consists of one pound of commercial aloes with four gallons of water. A tea made by steeping quassia chips is also used.[1] A combination of potash and clay is occasionally employed, and is mixed so as to have a consistency like that of thick cream. A writer in the 'American Garden' recommends rubbing the bark thoroughly with blood or grease, and asserts that rabbits will not touch trees that have been treated in this way. He adds: "In the case of trees which have been gnawed or peeled, the wound should be covered with a cloth on which is spread a little grafting wax. This not only excludes the air, but also helps the injured part to heal." The New Zealand department of agriculture has recently recommended a paint made of cow dung, clay, and soot and slightly flavored with tar or spirits of tar for protecting the stems of trees from rabbits.[2] Too much reliance should not be placed on smearing the trunks of trees, and no mixture should be used which contains petroleum in any form. Blood or grease will soon cease to be effective and it becomes necessary to repaint the trees in a short time.

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[1] Coghlan, Wealth and Progress of New South Wales, 1891, Vol. I, p. 356.

[2] Year Book of Australia, 1894, p. 145.

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[1] Wickson, *l. c.*, p. 553; 2d ed., p. 577.

[2] Leaflets for Gardeners, etc., No. 10, June, 1895, p. 8.

CHAPTER IV.

METHODS OF DESTRUCTION.

The destruction of rabbits has been so carefully investigated in Australia that it may be well to refer briefly to the conclusions arrived at by the Royal Commission which was appointed to inquire into schemes for the extermination of rabbits in Australasia. In a proclamation dated August 31, 1887, the government of New South Wales offered a reward of £25,000 for the effectual extermination of rabbits by any method or process not previously known in the colony, but three years later a report was made that "after prolonged and careful study of all the proposals which have been submitted, the commission finds that no scheme has been propounded for the extermination of rabbits which complies with the terms of the proclamation."[1]

INOCULATION.

The question of introducing infectious diseases was also carefully considered, but while the commission "found no evidence to warrant the belief that any known disease can be so employed as to exterminate rabbits," it suggested that many diseases would probably be found useful auxiliaries in keeping the rabbit plague within manageable proportions.[2]

The success of disease as a means of destruction depends on two conditions: (1) It must be fatal to the rabbits; (2) it must not injure man or domesticated animals. The Australian experiments were mainly confined to the effects of (1) chicken cholera, (2) the so-called 'Tintinallogy disease,' (3) diseases caused by the bladder worm (*Cœnurus*), and (4) by rabbit scab (*Sarcoptes cuniculi*). It was found that while the rabbits were easily killed by putting microbes of chicken cholera in their food the disease did not spread freely from infected to healthy animals. The Tintinallogy disease takes its name from a station on the east bank of the Darling River near Menindie, New South Wales, where a peculiar affection was noticed among the rabbits in September 1887. The principal symptoms are erection of the fur, beginning on the head; slight discharge from the eyes and nose, lasting three or four days; emaciation, followed by loss of power in the hind legs, and finally death with convulsions in about three weeks. Experiments were made with this disease on a large scale, but were only partially successful. In addition to the bladder worm and rabbit scab, experiments have been made in New Zealand with rabbit measles (*Cysticercus pisiformis*) and liver coccidium (*Coccidium oviforme*). The latter parasite is injurious to man, and its introduction is therefore dangerous. Diseases caused by parasites do not offer much hope as a successful method of destroying rabbits, as their effects at best can be only indirect by bringing about a condition of general weakness and emaciation, and thereby rendering the animal more subject to attacks of other diseases. A full account of these experiments will be found in the report of Prof. A. P. W. Thomas on The Rabbit Nuisance in New Zealand, 1888, and the Report of the New South Wales Royal Commission on the Introduction of Contagious Diseases amongst Rabbits, Sydney, 1889.

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[1] New South Wales Roy. Comm. Inquiry Exterm. Rabbits in Australasia, Final Report, 1890, p. 11.

[2] L. c., p. 3.

Further inquiry into the epidemic and parasitic diseases of rabbits was advised by the New South Wales commission, and it may be added that this means of destruction seems to promise better success in this country, where large numbers of jack rabbits are destroyed every few years by epidemics.

METHODS USED IN AUSTRALIA.

No less than 1,456 persons submitted schemes to the Australian commission for the destruction of rabbits by methods other than disease. The various schemes were arranged under the following heads:[1]

1. Commercial utilization.
2. Fencing.
3. Poisons.
4. Natural enemies.
5. Traps.
6. Electricity.
7. Miscellaneous, including firing the country, cutting off from food and water, hunting and trapping parties, etc.
8. Indefinite methods.
9. General methods.
10. Methods involving special legislation.

A method which has been tried with some success in New South Wales, consists in capturing a number of rabbits alive and allowing the males to escape after killing all the females. As soon as the males begin to predominate in numbers, it is said that they persecute the females with their attentions to such an extent as to prevent them from breeding, and also kill the young that happen to be born.[2]

The Australian commissioners did not favor commercial utilization, because "the principle of making rabbits a profitable article of commerce is universally condemned by practical men interested in their destruction, on the ground that it leads to their conservation." This method, however, has recently been brought to notice and seems to be one of the most promising (see pp. 65–78).

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[1] Final Report, 1890, pp. 3-4.

[2] Nature, XXXIX, March 21, 1889, pp. 493-494.

The question of fences has already been discussed under the head of prevention of injury to crops (pp. 33–34). Poisons, bounties, and natural enemies will be considered in detail further on. The other schemes were found to be either impracticable or unworthy of recommendation for use on a large scale.

The most successful traps used in New South Wales have been yards or inclosures made of rabbit-proof fence with openings which allow the rabbits to enter but prevent their getting out. Such traps have been found most efficient in dry seasons, when food and water are scarce. Several methods of using electricity were submitted, but all were found impracticable. Firing might be employed in some cases, but is attended with more or less danger. Cutting off the animals from food can only be used under certain favorable conditions.

Hunting and trapping parties have not accomplished much in Australia, but in certain parts of the United States a modification of this method has proved to be the most successful means of destroying large numbers of jack rabbits. (See chapter on rabbit drives, pp. 47–64.)

POISON.

In this country poison has been used to some extent, although less successfully than the gun and club. As none of the jack rabbits burrow, the poison must be scattered about on the surface of the ground where the rabbits are likely to find it, but the bait should not be placed where domesticated animals or poultry can eat it. Promiscuous scattering of poison in the orchard and vineyard is not to be recommended under ordinary circumstances, and when it can not be placed in holes or out of the reach of animals for which it was not intended the danger is greatly increased. The importance of this fact can hardly be overestimated, and every possible precaution should be taken in using poison for jack rabbits. In Australia experiments have been made with strychnine, phosphorus, arsenic, corrosive sublimate, lead salts, tartar emetic, barium carbonate, and sulphate of iron. Arsenic may be simply sprinkled on any food which will attract the rabbits, but it is more effectual when dissolved and the bait soaked in the solution. Paris green, London purple, lead salts, tartar emetic, barium carbonate, and sulphate of iron have not been found sufficiently active for killing rabbits, and corrosive sublimate has a powerful acrid and metallic taste, which may render it unpalatable to them.

Of all the poisons mentioned above, strychnine is the most effective. As the ordinary crystals of strychnine are almost insoluble in water, the sulphate should be used when the poison is to be dissolved. It may be placed on bits of watermelon, cantaloupe, or vegetables of which the rabbits are fond, and scattered around the orchard or vineyard. Rabbits are said to be attracted by a mixture composed of half a teaspoonful of powdered strychnine, two teaspoonfuls of fine salt, and four of granulated sugar, thoroughly shaken up and placed in small piles on a board.[1] Dr. John Strentzel, of Martinez, Cal., recommends mixing the strychnine with grain which has been well sweetened with oil of anise or rhodium and placing it where it will be readily found by the animals. Mr. A. Plumley, of Byron, Cal., uses dry pulverized strychnine with wheat or barley that has been soaked in water and slightly warmed. Sugar and flour are added in suitable quantities and the poison carefully mixed with the grain and spread out to dry. The addition of sugar and flour makes the strychnine adhere to the grain, and the mixture is reported highly successful. Maj. G. F. Merriam, of Twin Oaks, Cal., recommends soaking the wheat in water containing strychnine. The wheat is barely covered with water and allowed to soak until the grain is soft, and then dried as thoroughly and quickly as possible. A handful of this dry wheat is placed among the vines or scattered in the trails made by the rabbits.

Phosphorus is advocated by many persons, but it must be thoroughly soaked into the grain; if simply deposited on the outside and not covered with some protective material it will oxidize rapidly. Wheat soaked in water containing phosphorus is highly recommended. It should be used in the following proportion: One hundred pounds of grain, 1 pound of phosphorus, 1 pound of sugar, 1 ounce of oil of rhodium to 9 gallons of water. The mixture should be heated to the boiling point and allowed to stand over night, then enough flour added to make it a paste.[1]

In Australia preparations of phosphorus have been more generally used. A writer in the 'Kyneton Guardian' gives the following directions for preparing the poison: Four and one-half ounces of phosphorus are put into a gallon of boiling water and kept boiling for thirty minutes, while the phosphorus is thoroughly stirred. The liquid should be passed through a fine strainer. Fourteen or 15 pounds of malt are then stirred in and allowed to boil slowly for fifteen minutes, and finally 3 pounds of flour and 4 pounds of sugar are added. The mixture is sown like turnip seed, in furrows plowed here and there in rabbit-infested places.

Another method of preparing phosphorus, known as the 'Lascelles process,' "consists in (1) dissolving the phosphorus in bisulphide of carbon, (2) mixing the solution so obtained in a churn with flour paste so as to form an emulsion, and (3) coating the wheat in a revolving cylinder with this emulsion. The solution of phosphorus is made and kept under water, so as to prevent spontaneous combustion. This method has the advantages of facility and quickness, of the even distribution of the poison over the grain, and also of the prevention of volatilization by the coating with flour paste."[2]

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[1] Wickson, California Fruits, 1889, p. 554; 2d ed., 1891, p. 578.

[2] Final Report, Royal Comm. Inquiry into Schemes Exterm. Rabbits Australasia, 1890, p. 6.

BOUNTIES.

Bounties have been paid on jack rabbits in five of the Western States—California, Idaho, Oregon, Texas, and Utah—but the amounts have been small as compared with similar expenditures for the destruction of other animals. In Oregon, Texas, and Utah the rates were fixed by State laws, but in California the bounties varied in different counties. Bounties on rabbits have been even less successful, so far as extermination is concerned, than those offered for coyotes, prairie dogs, pocket gophers, or ground squirrels.

CALIFORNIA.

One the main objects of bounties in California, particularly those offered by the counties in the San Joaquin Valley, was to encourage rabbit drives, and in some cases the payments were almost sufficient to defray such expenses. Eight counties have offered bounties during recent years, namely, Butte, Colusa, Fresno, Modoc, San Bernardino, Shasta, Sutter, and Tulare. In the case of Sutter County, and possibly one or two others, the returns include amounts expended for pocket gophers and ground squirrels. Bounties are seldom offered on rabbits alone, and it is difficult to obtain the amounts expended for each species.

A rate of 10 cents per scalp was paid both by Butte and Colusa counties—the highest rate paid for any considerable length of time. In Butte County it was maintained from January 7, 1887, to February 1, 1890; in Colusa, from February 10, 1888, to September 12, 1892. The bounty was then reduced to 4 cents and continued to February 1, 1894.

In Fresno the bounty was offered merely to defray the expenses of the rabbit drives, and was not paid unless at least 1,000 pairs of ears were presented at one time. The total amount expended was about $500, indicating that more than 33,000 scalps were received.

In the spring of 1886 the supervisors of Modoc County offered 3 cents apiece for rabbit scalps, and in three months expended $826.77 for 27,559 scalps.[1]

The bounty offered by San Bernardino County about two years after the passage of the coyote scalp act of 1891, is unique from the fact that its main object was to offset the effect of the State bounty on coyotes. The ordinance went into effect August 25, 1893, and expired by limitation on December 6 of the same year. It provided that the rabbits must be killed within 2 miles of a cultivated orchard, nursery, vineyard, or alfalfa field not less than 1 acre in extent, and the scalps must be deposited within thirty days with a justice of the peace of the township in which the animals were killed.

Tulare County expended $5,000 for bounties on ground squirrels previous to November 1894, besides paying $3,000 for bounties on rabbits. The 'Los Angeles Times' states that no less than 4,000 scalps were secured in the drive near Traver, March 6, 1892, and as many as 5,391 have been deposited by a single person at one time. The ordinance under which these bounties were paid will serve as an illustration of those in other counties. It was passed October 31, 1891, and reads as follows:

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[1] Forest and Stream, XXVII, August 5, 1886, p. 26.

ORDINANCE NO. 46.

The board of supervisors of the County of Tulare, State of California, do ordain as follows:

SECTION 1. [Provides for a bounty of 2½ cents on ground squirrel scalps.]

SEC. 2. That a bounty of one and one-half ($0.01½) cents be paid by this county on each and every scalp taken from a jack rabbit, containing both ears of said dead animal, killed or destroyed by any person or persons in this county, upon the said person or persons so killing or destroying said animal depositing said scalp or scalps with any notary public, justice of the peace, or any officer authorized by law to take affidavits, and certify claim with said affidavit, together with affidavit of such officer that said scalp or scalps have been destroyed by fire to this board.

SEC. 3. That said bounty shall be paid by the county until such time when the funds set apart for that purpose shall be exhausted, or until this ordinance be repealed or rescinded by this board.

SEC. 4. That this ordinance take effect and be in force from and after the 31st day of October, 1891.

SEC. 5. [Provides for publication of the ordinance.]

So far as figures are available, the amount expended in California is about $16,000, although no returns have been received from San Bernardino County. The amounts disbursed are shown below:

Table showing expenditures for Bounties by Counties in California.

County.	Bounty in force.	Number of scalps.	Rate per scalp.	Amount expended.
			Cents.	
Butte	Jan. 7, 1887, to Feb. 1, 1890	* 35,000	10	$3,500.00
Colusa	Feb. 10, 1888, to Sept. 12, 1892		10	4,800.00
	Sept. 12, 1892, to Feb. 1, 1894		4	
Fresno		*33,000	1½	500.00
Modoc	Three months, 1886	27,559	3	826.77
San Bernardino	Aug. 25 to Dec. 6, 1893		20	
Shasta	May 11, 1891, to Mar. 1, 1892		5	342.55
Sutter	Sept. 25, 1893, to July 9, 1894		8	†3,040.42
Tulare	Oct. 31, 1891, to Nov., 1894?	*200,000	1½	3,000.00

* Estimated from amounts expended.
† Includes also bounties on gophers and ground squirrels, at 5 cents per scalp.

IDAHO.

Two counties in Idaho—Ada and Canyon—are now paying bounties on jack rabbits at the rate of 3 cents per scalp. Mr. Charles S. Kingsley, county clerk, has kindly supplied the figures for the expenditures in Ada County, and wrote, under date of August 24, 1895, as follows:

"The county began the payment of bounty July, 1878, and from that time until October, 1886, paid $8,129.75; from the latter date to the

8th day of July, 1895, the county paid the sum of $22,963.69, making an aggregate of $31,093.44.

"I have myself been much interested in these figures, and find that during the 33 quarters embraced in the first period stated the average quarterly amount was $232.27, while during the 35 quarters embraced in the last period the average quarterly payment amounted to $850.50. It is noteworthy that during 1887 (latter part), 1888, 1889, and part of 1890 the average quarterly payments dropped to approximately $100. This was due to the very great destruction of rabbits during the winter of 1887 by extreme cold. It is thus seen that the average has been growing larger, notwithstanding the bounty, and the figures for the last quarter are $2,520.65; that, with the current quarter, are of course the heavy quarters of the year, and it is possible the total average per quarter for the year [1895] will not exceed $1,000. These figures seem to indicate that the bounty is not a success in the matter of exterminating the pests,"—and yet at the rate of 3 cents apiece more than 1,000,000 rabbits must have been destroyed.

OREGON.

Under the session laws of Oregon, 1887, a bounty varying from 1 to 5 cents was offered for jack rabbits. The law specially stated that this bounty was to be paid for the Black-tailed Rabbit, and none seems to have been paid on the Plains Jack Rabbit (*Lepus campestris*), which occurs in the same region. During the years 1888, 1889, and 1890, Lake County paid bounties on 54,000 rabbit scalps at the rate of 4 cents each, amounting in all to $2,160.

TEXAS.

In April, 1891, the legislature of Texas passed "An act to protect stock raisers, farmers, and horticulturists," which provided—

> That hereafter when any person shall kill any wolf, either coyote or lobo, panther, Mexican lion, tiger, leopard, wild-cat, catamount, or jack rabbit, he shall be paid in the county in which he kills such animal or animals the sum of two dollars for each coyote, and the sum of one dollar for each wild-cat or catamount, and the sum of five dollars for each panther, lobo, Mexican lion, tiger, or leopard, and the sum of one dollar per dozen for jack rabbits, and fifty cents per dozen for prairie dogs so killed.[1]

The sum of $50,000 was appropriated and expended in carrying out the provisions of this law. Unfortunately it has not been possible to obtain the amounts paid for each of the animals named, so that the total bounty on jack rabbits can not be stated. The burden of this expenditure fell so heavily on some of the southwestern counties of the State that the law was repealed in March, 1895, and a new act substituted which made the payment of bounties optional with the counties, and omitted jack rabbits and prairie dogs from the list of proscribed animals.

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[1] General Laws of the State of Texas, 22d legislature, 1891, p. 160, chap. 100, sec. 1.

UTAH.

Section 2114 of the laws of Utah for 1890 authorized the county courts to offer bounties for the destruction of jack rabbits and certain other injurious animals. On September 1, 1893, a bounty of 5 cents per scalp was placed on rabbits by the court of Boxelder County. This rate was maintained until January 28, 1895, when it was reduced to 2 cents per scalp. The county clerk reports that up to December 31, 1895, bounties had been paid on 111 coyotes at 50 cents each, while more than $500 had been expended for rabbits, as follows:

Table showing expenditures for Bounties in Utah.

County.	Date.	Number of scalps.	Rate per scalp.	Amount expended.
			Cents.	
Boxelder	Jan. 1–Sept 1, 1893	716	2	$14.32
Do	Sept. 1, 1893–Jan. 28, 1895	9,179	5	458.95
Do	Jan. 28–Dec. 31, 1895	2,863	2	57.26
Total		12,758		$530.53

Bounties represent the only expenditures made by counties or States in this country for the destruction of rabbits. As shown above, the totals, including the State bounty of Texas, which was paid on several other species of animals, aggregate about $100,000, an amount which is insignificant when compared with that spent in Australia.

EXPENDITURES IN AUSTRALIA.

The common rabbit of Europe (*Lepus cuniculus*) was introduced into Australia about the year 1864 at Barwon Park, near Geelong, Victoria.[1] In the course of a few years it spread over Victoria and westward into South Australia, crossing the Murray River in 1878. The following year legislative action for the destruction of the pest was inaugurated by South Australia, and the example was soon followed by Victoria, New South Wales, New Zealand, Queensland, and Tasmania. No less than 19,182,539 rabbits were destroyed in New South Wales alone in 1887.[2] But in addition to the direct payment of bounties, the governments of the colonies have expended large sums for poisons, for experiments on various methods of destruction, and have built several thousand miles of rabbit-proof fences. As shown by the following table, the total amount expended up to 1888 was £1,093,890 (more than $5,000,000) in addition to £96,264 (nearly $500,000) for fences.

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[1] According to Hon. James M. Morgan, formerly United States consul-general at Melbourne, rabbits were first introduced in western Victoria about 1860, for the purpose of sport. (Consular Reports for Dec., 1886, XX, p. 482.)

[2] Circular on Rabbit Destruction. Committee New South Wales Comm. Pastoral and Agr. Ass., Jan., 1888.

Government Expenditures for Destruction of Rabbits in Australia and New Zealand, 1879–1888.[*]

Colony.	Date.	Amount.	Remarks.
New South Wales	1883–1888	[†] £732, 236	£23,997 also expended for fences.
Queensland	Up to Dec., 1887	(‡)	£59,737 for fences.
South Australia	1881–1888	128, 595	
Victoria	1879–1888	131, 724	On unoccupied Crown lands.
New Zealand	1882–1888	18, 453	£12,530 also expended for South Canterbury fence.
Tasmania	May, 1883–Jan., 1888	82, 882	
Total		1, 093, 890	Add £96,264 for fences.

[*] Progress Rept. New South Wales Royal Com. Inquiry Exterm. Rabbits. 1890, App. II. pp. 190–192.

[†] Hon. J. H. Carruthers, Minister for Lands, gives £831,457 4s. 1d., as the total amount expended from the passage of the rabbit act in 1883 to June 30, 1890. The figures for each year are less in nearly every case than in the statement quoted above, but represent the sums disbursed "solely for the purpose of attempting to get rid of the rabbit." From July 1, 1890, to December 31, 1894, the expenditure amounted to only £22,761, which was devoted to fences. (Rept. Conference Rabbit Pest in New South Wales, 1895, p. 6.)

[‡] Total expenditures up to 1894 (largely for fences), £136,484 8s. (Year Book Australia for 1894, p. 145.)

NATURAL ENEMIES OF JACK RABBITS.

Birds of prey seldom molest the larger hares. Among those which are known to feed on jack rabbits are the barn owl (*Strix pratincola*), Audubon's caracara (*Polyborus cheriway*), prairie falcon (*Falco mexicanus*), and western red-tailed hawk; but remains of the Texan rabbit have been found in the stomach of the red-tail in only three cases among a large number examined. The western horned owl (*Bubo virginianus subarcticus*) and the golden eagle (*Aquila chrysætos*) should also be mentioned. The marsh hawk (*Circus hudsonius*) occasionally attacks rabbits, and Mr. J. Alden Loring shot one at Vernon, Tex., while in the act of killing a young jack rabbit which weighed a pound and a half.

The mammals in this list are likewise few in number, the most important being the coyote (*Canis latrans*), gray wolf (*Canis nubilus*), long-eared fox (*Vulpes macrotis*), gray fox (*Urocyon*), and wild-cat (*Lynx*). Skunks, weasels, and badgers may occasionally destroy the young, but seldom, if ever, the full-grown hares. The badger, an indefatigable hunter of the ground squirrel and the prairie dog, is too slow of foot to overtake the jack rabbit in a fair race, and is unable to corner him in a hole, as he can a burrowing animal.

On the Great Plains the gray wolf undoubtedly destroys large numbers of jack rabbits in the region from Colorado northward. In Montana, according to Dr. George Bird Grinnell,[1] "The abundance or scarcity of the prairie hare in any district depends almost altogether on the number of wolves to be found in the same tract of country. Where all the coyotes and gray wolves have been killed or driven off, the hares exist in great numbers; but where the former are abundant, the latter are seldom seen. We saw none near the Missouri River, where the buffaloes, and consequently the wolves, were numerous; but at Camp

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[1] Ludlow's Rept. Reconnaissance Yellowstone Nat. Park, 1876, p. 69.

Baker, where there were scarcely any wolves, the hares were very common."

The coyote is a most effective rabbit destroyer and accomplishes more good in this way than he usually receives credit for. His true value, however, is beginning to be appreciated by fruit growers. The following notes contributed by Mr. Vernon Bailey show how coyotes sometimes prey on jack rabbits. Mr. Bailey says:

> In trapping on the greasewood flats about Kelton, in northern Utah, during the latter part of October, 1888, I noticed in many places that jack rabbits (*Lepus texianus*) had been killed and eaten by some animal. The feet, bits of skin, and fur were usually all that remained, but I immediately attributed this destruction to coyotes, and later on was able to verify the conclusion by finding remains of rabbits surrounded by fresh coyote tracks. In a walk of a mile it was common to see where a dozen had been eaten, and I could even see where the coyotes had run and caught the rabbits. I was surprised at the number killed, although both rabbits and coyotes were numerous. As I walked through the brush jack rabbits would jump up and run every few minutes, and coyotes were frequently seen. In this particular spot the numerous bunches of greasewood (*Sarcobatus*) scattered over the smooth valley bottom gave the coyotes a great advantage, enabling them to approach close to the rabbits and probably catch them before they got fairly started. It is very doubtful if a coyote can catch a jack rabbit in a fair race on open ground.

About five years ago the State of California offered a bounty of $5 each for coyote scalps. The act was passed March 31, 1891, and provided that such scalps should be deposited with the clerk of the board of supervisors of the county in which the animal was taken, within three months after the date of capture, and must be accompanied by an affidavit showing the time and place that the animal was killed. The law practically remained in force up to September 30, 1892, when the State board of examiners refused to pass on any claims for scalps taken subsequent to that date. The State controller reports that the sum paid for scalps during the eighteen months that the law remained in effect was $187,485, and that up to June 30, 1894, no less than 71,723 coyote scalps had been presented, with claims for bounty amounting to $358,615. This immense destruction of coyotes has permitted the increase of the smaller animals on which they feed. Complaints have been made that the rabbits are increasing in numbers and that the damage done by them is greater than that caused by the coyotes. As already stated, the county of San Bernardino in 1893 offered the unusually high bounty of 20 cents apiece on the rabbits, which, as a result of this wholesale destruction of coyotes, had so greatly increased in numbers. In this remarkable case of legislation a large bounty was offered by a county in the interest of fruit growers to counteract the effects of a State bounty expended mainly for the benefit of sheep owners!

EPIDEMICS.

Jack rabbits are subject to epidemics, which occasionally reduce their numbers very materially. These outbreaks are more or less local, but are reported every few years. According to Mr. George Watkins, rabbits were found in large numbers in Ash Meadows, Nevada, previous to 1891, but in the spring of that year they were very rare. He attributed the decrease to the prevalence of an epidemic, which had been so severe as to render these animals almost extinct. In northeastern California Mr. A. C. Lowell, of Fort Bidwell, Modoc County, mentions seeing many dead rabbits in the autumn of 1893.

A similar occurrence is reported by Mr. F. Stephens, near Beckworth Pass, Plumas County. Speaking of a trip through northeastern California in August, 1894, he says: "The epidemic among hares was widespread through all the region I passed over north of Beckworth Pass, being perhaps most noticeable in the Madeline Plain on the South Fork of Pitt River and near the Nevada line south of Surprise Valley. In all these places I saw daily dozens of carcasses near the road. The only cause of death that I could see was the abundant warbles (*Cuterebra*) present in nearly all. It would seem, though, that these could only operate by lowering the state of health generally and that some contagious disease was present."

Dr. J. A. Allen[1] speaks of an outbreak that occurred in the vicinity of Great Salt Lake in 1870–71, destroying large numbers of *Lepus texianus* and *L. campestris;* and Prof. Marcus E. Jones states that another occurred in Utah in 1885 or 1886. A similar instance of the destruction of the Prairie Hare (*Lepus campestris*) has been mentioned by Mr. Gibbs and Dr. Cooper, which occurred in Washington north of the Columbia River about 1853.[1] Mr. Clark P. Streator, while at Pasco, Wash., near the mouth of Snake River, learned that another epidemic had occurred among the rabbits in the vicinity during the summer of 1890. Maj. Chas. Bendire states that the inhabitants of the Payette Valley, Idaho, claim that epidemics occur among the jack rabbits in that region every five or six years. The following table gives briefly the epidemics which have been reported in the West during the last forty years, but the list is very incomplete:

Partial List of Rabbit Epidemics in the West.

State.	Locality.	Date.	Authority.
California	Fresno County	Autumn, 1892	Geo. B. Otis, Selma.
Do	Modoc County	Autumn, 1893	A. C. Lowell, Fort Bidwell.
Do	Modoc to Plumas County	August, 1894	F. Stephens.
Idaho	Payette Valley	(Frequent) 1878	Maj. Chas. Bendire.
Nevada	Ash Meadows, Nye County	Spring, 1891	George Watkins, Ash Meadows.
Utah	Near Great Salt Lake	1870–71	J. A. Allen, Mon. N. Am. Rodentia, 1877, p. 372.
Do	Iron County	1877	M. Richards, jr., Parowan.
Do	Central Utah	1885 or 1886	Marcus E. Jones, Salt Lake City.
Washington	North of the Columbia	About 1853	Cooper & Gibbs, Pac. R. R. Repts., XII, Pt. II, 1860, pp. 87, 131.
Do	Near mouth Snake River	Summer, 1890	Clark P. Streator.

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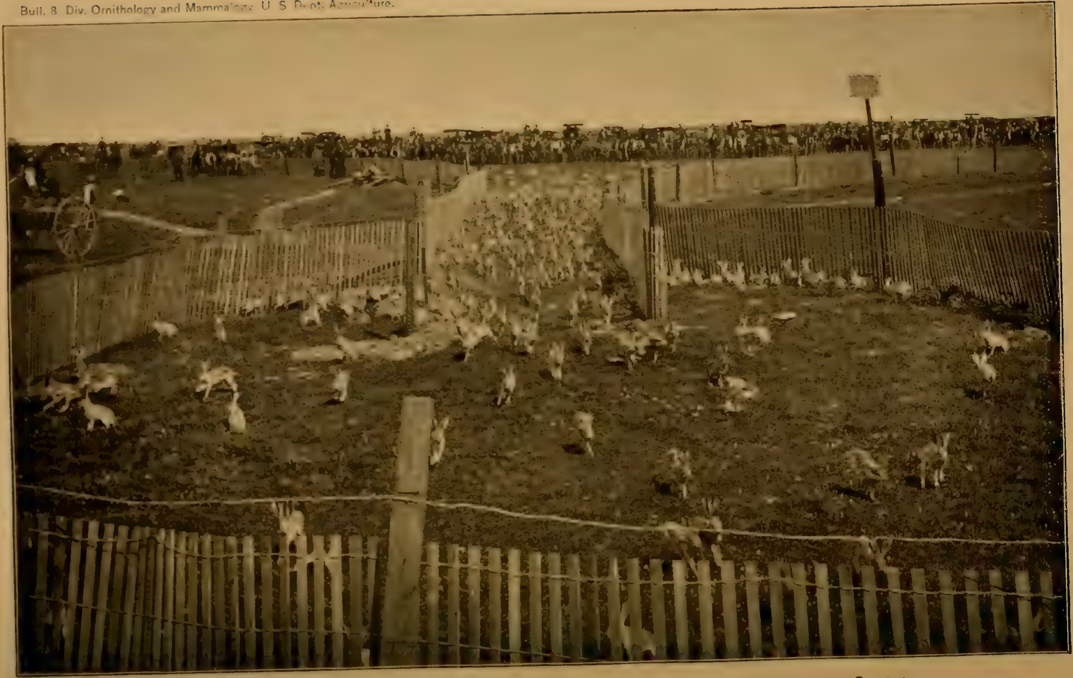
[1] Monographs of American Rodentia, 1877, p. 372.



A JACK RABBIT DRIVE NEAR FRESNO, CALIFORNIA, MAY 5, 1894.—RABBITS ENTERING THE CORRAL.

CHAPTER V.

RABBIT DRIVES AND HUNTS.

CALIFORNIA.

In certain parts of California where jack rabbits are found in great numbers the 'drive' has proved the most successful means of extermination. Rabbit driving seems to have been first introduced in the San Joaquin Valley, near Tipton, Tulare County, in 1882, but did not attract much attention until the winter of 1887–88. This was during the 'boom' in southern California, and it is probable that the influx of people from the East, many of whom settled in the San Joaquin Valley, was one of the causes of the sudden interest in rabbit drives. Large tracts of land were brought under cultivation in sections where jack rabbits were very abundant, and it became absolutely necessary to adopt some effective means of protecting the newly planted orchards and vineyards.

The origin of the method, however, is somewhat obscure. It is said that the Mission Indians formerly hunted both cottontails and jack rabbits on horseback. A dozen or more Indians armed with clubs would engage in such a hunt, and, riding at full speed through the underbrush, would start the rabbits from their hiding places. The cottontails, confused by the clattering of the horses' hoofs and the shouts of the riders, would turn this way and that, and either dodge into their holes or squat close to the ground, only to be dispatched by a swift blow from a club. The jack rabbits, on the contrary, usually made for the open plain, where they were turned in their flight, and soon surrounded and killed.

Long before the settlement of the country by the whites, the Indians were accustomed to capture large numbers of jack rabbits with nets, the animals being surrounded and driven into an inclosure, where they were killed with clubs. One of the earliest accounts of this custom is contained in Townsend's 'Narrative of a Journey across the Rocky Mountains,' published in 1839 (p. 327). In speaking of the Blacktailed Jack Rabbit found near Walla Walla, Wash., he says: "The Indians kill them with arrows, by approaching them stealthily as they lie concealed under the bushes, and in winter take them with nets. To do this, some one or two hundred Indians, men, women, and children, collect and inclose a large space with a slight net, about 5 feet wide, made of hemp; the net is kept in a vertical position by pointed sticks attached to it and driven into the ground. These sticks are placed about 5 or 6 feet apart, and at each one an Indian is stationed with a short club in his hand. After these arrangements are completed, a large number of Indians enter the circle, and beat the bushes in every direction. The frightened hares dart off toward the nets, and, in attempting to pass, are knocked on the head and secured. Mr. Pambrun, the superintendent of Fort Walla Walla, from whom I obtained this account, says that he has often participated in this sport with the Indians, and has known several hundred to be thus taken in a day. When captured alive, it does not scream, like the common gray rabbit (*Lepus sylvaticus*)."

The Indians of southern Oregon also carried on rabbit drives some years ago, especially near the Oregon-Nevada boundary line, near Fort McDermitt. Several hundred rabbits were killed at a time and utilized for food, while their skins were made into clothing. During his second expedition, Col. J. C. Frémont found the same method of capturing rabbits used by the Piutes of Nevada and eastern California.[1] In describing one of his camps on the east slope of the Sierra Nevada, evidently near the head of the Truckee River, he says, under date of January 31, 1844: "We had scarcely lighted our fires when the camp was crowded with nearly naked Indians; some of them were furnished with long nets in addition to bows, and appeared to have been out on the sage hills to hunt rabbits. These nets were perhaps 30 to 40 feet long, kept upright in the ground by slight stakes at intervals, and were made from a kind of wild hemp, very much resembling in manufacture those common among the Indians of the Sacramento Valley."

Maj. Chas. Bendire, while returning from Deep Spring Valley to Camp Independence, Cal., in November, 1866 or 1867, saw the Indians engaged in driving jack rabbits on the east side of Owens Valley, a few miles south of Bishop. A corral had been made by stretching low nets between stakes placed about 20 feet apart. Into the inclosure thus formed the animals were driven from a considerable area in the valley, and it was estimated that 300 or 400 rabbits were killed in this drive. The nets were made by the Indians, and each hunter was required to furnish his quota. Mr. F. V. Coville, botanist of the Death Valley Expedition, learned that similar nets were formerly used by the Indians of Ash Meadows, Nevada. These nets were made from the Indian hemp (*Apocynum cannabinum*), which furnishes a strong and excellent fiber. The same material was evidently used by the tribes in the eastern part of the State, for Bancroft, in speaking of the Indians near the Utah boundary, says: "The Gosh Utes take rabbits in nets made of flax twine, about 3 feet wide and of considerable length. A fence of sage brush is erected across the rabbit paths, and on this the net is hung. The rabbits in running quickly along the trail become entangled in the meshes and are taken before they can escape." (Native Races of the Pacific States, I, 1874, p. 428.)

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[1] Rept. Expl. Expd. to Oregon and Calif., 1845, p. 227 (House Doc. No. 166.)

The Moki Indians, of northeastern Arizona, have practiced rabbit driving for a number of years. The hunts are made both on foot and with horses, and the rabbits are simply surrounded instead of being driven into an inclosure. A peculiar kind of weapon, resembling a boomerang, is employed in these hunts, and is thrown with such accuracy that it proves very effective in the hands of Indians accustomed to its use. Similar drives were also made by the Indians in northern New Mexico, near Espanola. The Piutes and other tribes in Utah used to assemble in large numbers in a valley near Cedar City, where they engaged in a grand hunt each November, killing thousands of rabbits for their skins and for food.

The modern 'rabbit drives' are conducted on much the same plan as those of the Indians, but precautions are taken beforehand so that no escape is left for the animals when once surrounded. A square or triangular inclosure, open at one end, is constructed of wire netting—or of laths securely fastened close together. Often a corner of some old corral is simply made rabbit-tight, and from the open end of the pen diverging fences or wings are carried out in the form of a wide-mouthed V, sometimes for a distance of 2 or 3 miles (see fig. 1). The fences are occasionally made in sections, so that they can be transported from one place to another, and thus used for several drives. The Goshen Rabbit Drive Club, organized in the spring of 1888, had an 'outfit' which cost about $150, and was considered one of the best in the San Joaquin Valley; it was used mainly near Goshen, but was also moved to Huron, Fresno County, where it did duty for some time. This outfit consisted of 1 mile of wire netting 28 inches wide, and 400 iron stakes three-fourths of an inch in diameter and 3 or 4 feet long. The stakes were set 15 or 20 feet apart, and the netting fastened to them. At the apex of the wings a circular corral was built 60 to 200 feet in diameter and provided with a sliding gate (see p. 50).

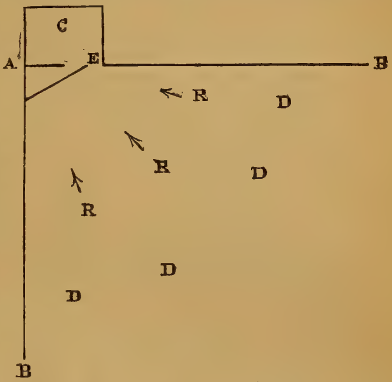

FIG. 1.—Diagram showing form of corral used in rabbit drive at Bakersfield, Cal., Jan 15, 1888.

A, B, portable wired picket fence, 1 mile long; C, corral; D, drivers; E, entrance to corral; R, rabbits. (From Am. Field, 1888.)

Mr. Charles S. Greene, in describing the drive at Traver on April 8, 1892,[1] states that the wings used on that occasion were made of wire netting and were not more than 2 feet high. Although he saw rabbits leap much higher during the early part of the drive they made no attempt to escape over the fences when the wings were reached, the animals evidently being too wearied, as they had been driven for some distance. On the other hand, in a small drive which took place near Claremont on September 9, 1893, no wings or corral were built, but an attempt was made to utilize a corner of a stone wall 3 or 4 feet in height instead. The rabbits were driven only a short distance and when the wall was reached it is said that most of them went over it like sheep, and comparatively few were killed. In the great drive at Wildflower, Fresno County, the wings, made of wire netting, were 3 feet in height and extended for a distance of 7 miles, converging toward a circular corral at the apex.[1]

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[1] Overland Monthly, 2d ser., XX, July, 1892, p. 54.

A drive always means a gala day, and is a favorite way of celebrating some special occasion. The announcement is the signal for a gathering of the clans from all the neighboring country and the population of the place is increased to several times its normal size when such an event takes place. Excursionists are attracted in large numbers by the special rates offered by the railroads, and sometimes come from points as far distant as San Francisco and Sacramento. Upon the appointed day large numbers of people turn out armed with sticks and clubs, and, scattering over a considerable area, start the rabbits and drive them toward the mouth of the corral. Every available vehicle is pressed into service, but the larger part of the throng is usually on foot. The lines gradually close in, and the frightened rabbits, urged on by blows and shouts, rush blindly into the opening between the wings and are gradually crowded toward the narrow end of the pen where they are soon dispatched with clubs. Firearms are seldom used either in driving or killing, as clubs are cheaper, safer, and equally effective. The drives take place in winter or spring, and the number of rabbits killed varies from a few hundred up to ten or even twenty thousand in a single day. The town of Traver regularly celebrates its birthday in April by a rabbit drive and barbecue. On April 8, 1892, it was estimated that no less than 6,000 persons were present, and more than 4,000 people and 1,000 teams took part.

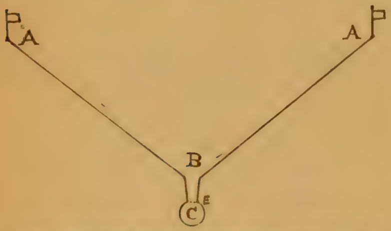

FIG. 2.—Diagram showing form of portable corral used by the Goshen Rabbit Drive Club.

A B, wings of wire netting each half a mile long; C, corral 60 to 200 feet in diameter; E, sliding gate. (From M. S. Featherstone.)

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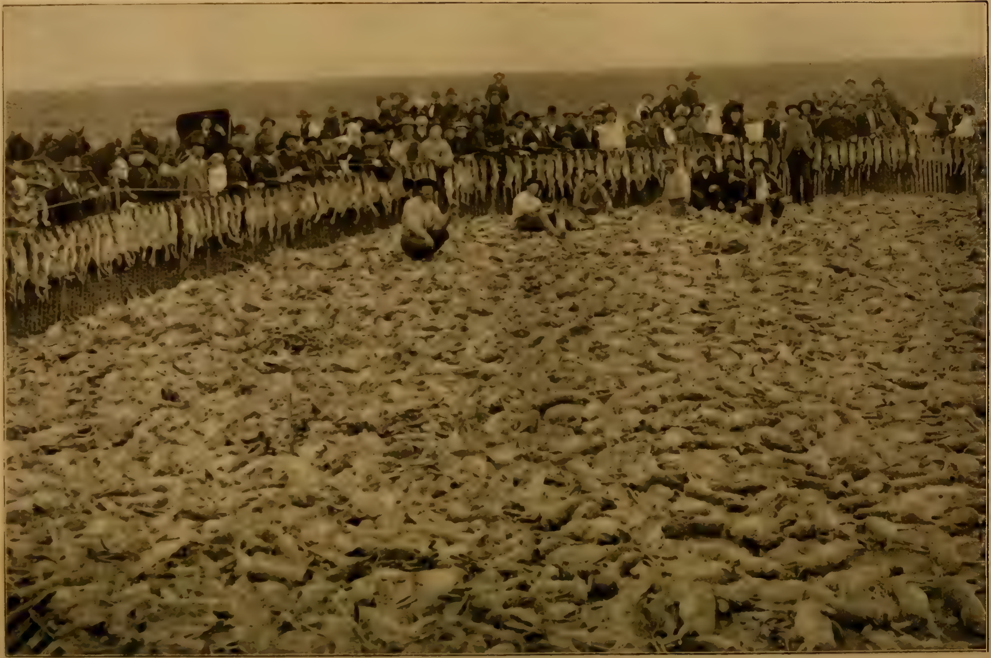
[1] See figure in Scientific American, LXI, No. 19., Nov. 9, 1889, p. 295.



RESULT OF THE GRAND ARMY RABBIT DRIVE AT FRESNO, CALIFORNIA—20,000 JACK RABBITS KILLED.

(From photograph by Stiffler.)

A writer in the Chicago Tribune of October 1, 1893, thus graphically describes one of the largest drives which has taken place in the vicinity of Fresno, Cal.:

> A close fence forming the corral is built about 500 yards square, with an opening or entrance for receiving the drive at one end, the opening being perhaps 50 feet wide. This is the finishing point of the drive, and will hold thousands of rabbits. From this opening diverge two fences, close enough to keep the rabbits from jumping through, about 5 feet high. These two fences diverge from the entrance for about 3 miles, increasing in their distance apart as they increase in distance from the entrance. * * *
>
> By 7 o'clock in the morning all is bustle and preparation for the drive. Some men have heavy sticks and some heavy clubs, but no pistols or any kind of firearms are allowed, and no dogs. The sticks and clubs are used to beat the brush and to kill the rabbits at the finish.
>
> A general is appointed to give orders, and under him are those who keep the lines in order. But sometimes they are anything but orderly. The order to start being given along the line, the cavalcade rushes forward. Boys with hoots and cries run hither and thither, wielding their sticks. Men on foot in advance lines are followed by those on horseback and in vehicles. Those on foot seem to have the best success in putting up the rabbits. * * *
>
> After advancing a few miles the commencement of the fences diverging from the corral can be seen. The scene is humorous at times, when a horseman is seen dashing at full speed after a jack rabbit and a man on foot running in another direction after another. Now hundreds of the poor creatures are easily discerned as the fences appear on the left and right, miles apart. Many try the back track only to meet death in the attempt. All the horsemen gallop in cowboy style, some with long sticks in their hands. Great numbers of rabbits dash in every direction in front of the advancing hosts, and far ahead the long ears of hundreds more can be seen racing for life, occasionally crouching and then starting ahead again, but still surely advancing into the inevitable death-trap. The close proximity to the finish makes the chase exciting. Those on foot are heated and eager. The fence on each side is closing in fast, and although still some distance from the corral the screaming of the poor creatures can be heard as they find their retreat cut off.
>
> The climax of the drive is now at hand. Hundreds of men and boys rush in every direction. The horsemen and carriages partly hide the view. The clouds of dust are stifling. Now the screeching of the rabbits can be heard above everything, and the ground is covered with dead rabbits by the dozen. At the corral entrance the scene is indescribably pitiful and distressing. * * * To slash and beat the poor screaming animals to death is the work of but a short time, but it brings tears to many an eye, and makes the heart sore to witness the finish. It is a relief to everybody when all is still, when the trying day is at an end. The result of the drive at Fresno was 20,000 dead rabbits.

The rabbits killed in the drives are utilized in various ways. If they are in good condition some are dressed and shipped to market where they find a ready sale. But usually the drives are carried on solely for the purpose of exterminating the pests. In localities where a bounty has been offered the ears are collected for 'scalps' and the bodies not saved for food are either used for fertilizing purposes, fed to hogs, or thrown away.

Drives have occurred in nine counties of California, viz: Inyo, Los Angeles, Modoc, Fresno, Kern, Kings, Madera, Merced, and Tulare. With the exception of those in Inyo, Los Angeles, and Modoc, all have taken place in the southern part of the San Joaquin Valley. Data are available for only a few drives east of the Sierra Nevada, one being the Indian hunt already mentioned, which took place in 1866, near Bishop, Inyo County, and the others in Modoc County in the extreme northeastern corner of the State—in Surprise Valley, just east of the Warner Mountains, and near Likely, on the South Fork of Pitt River. It may also be noticed that the drive at Claremont, Los Angeles County, is the only one which has occurred at a point well within the range of *Lepus californicus*, and although it resulted in the destruction of only about a hundred rabbits is especially interesting, as it seems to be one of the few drives in which the California Jack Rabbit alone was killed. All the large drives have been made in localities where the Texan Jack Rabbit is the predominant if not the only species. The largest drives have occurred in the vicinity of Bakersfield and Fresno. They usually extend over considerable country, and one of the Fresno drives has been described by Mr. Charles H. Townsend, in which nearly 2,000 horsemen took part. This hunt covered some 20 square miles, and about 15,000 rabbits were driven into a central corral and killed. (Forest and Stream, XXXVIII, March 3, 1892, p. 197.)

ORIGIN OF THE DRIVES.

The feasibility of driving jack rabbits into a corral for wholesale destruction was demonstrated about twenty years ago; but rabbit driving as now carried on, began within the last decade. At first the animals were shot instead of being killed with clubs, and these hunts were known as shotgun drives.

Mr. George W. Stewart, editor of the Visalia Delta, has kindly contributed the following notes concerning the early drives in California:

> The first rabbit drive in the San Joaquin Valley, and probably in the State, occurred in the year 1875. The firm of Haggin & Carr had begun to farm a large body of land in Kern County, at the southern end of the San Joaquin Valley, which up to that time had been used only as a cattle range. The manager, a Mr. Souther, was much annoyed by the ravages of thousands of jack rabbits on what is known as Kern Island [a tract of land about 15 miles long] formed at that time by branches of Kern River. Mr. Souther collected a large number of his vaqueros and other ranch hands, and these men, mounted and on foot, surrounded a large territory and gradually closed their lines toward a large cattle corral, into which the rabbits were driven. Many rabbits escaped through the line, but the result of this first drive was 1,200 rabbits and 2 coyotes. * * *
>
> The next great slaughter of jack rabbits occurred eleven years later near Hanford, now the county seat of Kings County. Notice had been given beforehand, and on March 3, 1886, about 250 men from Hanford and the adjacent country, armed with shotguns (rifles and pistols were barred), surrounded a large area of country 6 miles south of the town. As the circumference of the circle gradually lessened, the shooting commenced, and when less than a mile in diameter the firing was incessant, the continuous discharge making the noise of a small battle. When the last jack rabbit had been shot the army halted for a lunch. A number of men had shot as many as 50 rabbits each, and it was estimated that 3,000 had been slain. In the afternoon a fresh supply of ammunition was secured and another smaller tract of

country was surrounded and the battle continued. The result of the afternoon's work was 1,000 hares, making 4,000 for the day. One result of this exciting day was a realization of the danger of using guns in this manner; several people were peppered with shot, but none were seriously injured. * * *

The following year, 1887, the rabbits had become so destructive on the great Miller & Lux ranch, on the west side of Merced County, that men were employed to kill them. The hunters were supplied with horses, wagons, and ammunition, and were paid 5 cents for every rabbit killed. Over 7,000 were killed on that one ranch during the season.

The first large rabbit drive on the plan afterwards adopted took place near Pixley, in Tulare County, on November 14, 1887, a year and a half after the Hanford slaughter. Firearms of all kinds were forbidden, and dogs were not allowed within the lines. A corral of rabbit-proof wire was made, and from its entrance two V-shaped wings extended a distance of a mile and a half. Into this space the rabbits were driven. Many hundreds stampeded and broke through the line, but the result of the drive was 2,000.

The modern method of driving rabbits into a corral seems to have originated with Mr. W. J. Browning, a professional hunter, of Tipton, Tulare County. Stimulated by an offer of $1,000 for 1,000 live jack rabbits for coursing, Mr. Browning undertook to capture the animals by driving them into a corral made by stretching fish nets between posts. In a letter dated January 15, 1895, he says: "I commenced the business of trapping jack rabbits with a corral drive net, with wings about half a mile long, during the summer of 1882. I have shipped many thousands to all parts of the country, alive, for coursing purposes. * * * In driving, I use six or eight men mounted on good horses, and in this manner usually trap from 50 to 500 jacks. The big drives of this State were patterned after my system, as the first drive I ever heard of outside of my own was made [at Pixley] in this county in 1887, in the month of November."

In order to obtain all the information possible on the subject of rabbit driving, Mr. J. Ellis McLellan, a field agent of the division, was detailed to visit Merced, Fresno, Bakersfield, and other points in the San Joaquin Valley in the autumn of 1894. Mr. McLellan gathered many facts of interest, and the following brief account has been mainly condensed from his reports, while the list of drives on pages 55–57 is largely the result of his energy in collecting data.

Early in the autumn of 1887 the question of taking measures for a wholesale destruction of jack rabbits was discussed in Kern County, but nothing was done for some months, and the project would probably have proved a failure through apathy or opposition had it not been vigorously agitated by the press. In the meantime, however, an experiment was made at Pixley, Tulare County, and the first public drive took place there on November 14, 1887. Two thousand rabbits were killed, and it was demonstrated that jack rabbits could be successfully driven into a corral. Another drive took place on December 3, and 1,000 more were slaughtered. Rabbit driving began in earnest in Kern County on January 2, 1888. The first drive was made near

Bakersfield, and was followed by others at intervals of a week or ten days with such success that the method attracted widespread attention throughout the valley. Great interest was aroused in Tulare County, and on February 25 the 'Pioneer Rabbit Drivers' Club' was formed and driving was undertaken by various towns in quick succession. The first drive near Tipton took place January 28, at Tulare on February 1, at Waukena February 11, at Visalia March 16, and at Traver April 7. Not to be outdone by Kern and Tulare counties, the citizens of Fresno met on February 8, and decided to arrange for a rabbit drive and barbecue, which was held on March 16. An association for rabbit driving was also organized in Merced County, and the first drive took place at Merced on March 24. During this time the matter seems to have been dropped at Pixley and the credit of originating the novel method of rabbit destruction was claimed by several other towns.

In February and March, 1888, rabbit driving seems to have reached its height in the San Joaquin Valley. It was estimated by the newspapers that nearly 20,000 rabbits were killed in Tulare County during March alone; while about 40,000 were destroyed in Fresno, and 70,000 each in Kern and Tulare counties during the spring of 1888. With the close of this season there was a noticeable falling off in the number of drives, either through lack of interest or because the rabbits had decreased in numbers to some extent. Comparatively few took place in 1890 and 1891, but in the spring of 1892 several large ones were made in Fresno County. The largest on record occurred between Easton and Oleander, 10 or 15 miles southwest of Fresno, and formed the closing event of an encampment of the Grand Army of the Republic at Fresno, March 12, 1892. It is said that 8,000 people were present, and the estimates of the number of rabbits killed vary from 20,000 to 30,000 (see Pl. IV). The central location of Fresno makes it an easy matter to bring together large numbers of people at short notice. Since 1892 there has been a still further decrease both in the number and size of the drives, and except at Traver, hardly any large ones have taken place in the State. The custom has been somewhat revived during 1893 and 1894 in Modoc County, where it is said a few drives were held in 1889.

It is impracticable to give a complete list of all the drives or an accurate statement of the number of rabbits killed. The figures published in newspapers are probably often exaggerated, but in most cases afford the only data available. With the assistance of many correspondents statistics for about a hundred and fifty of the more important drives have been collected.[1] As shown by the following table, more than 370,000 rabbits have been destroyed, but these probably represent only a small proportion of the total number actually killed in California.

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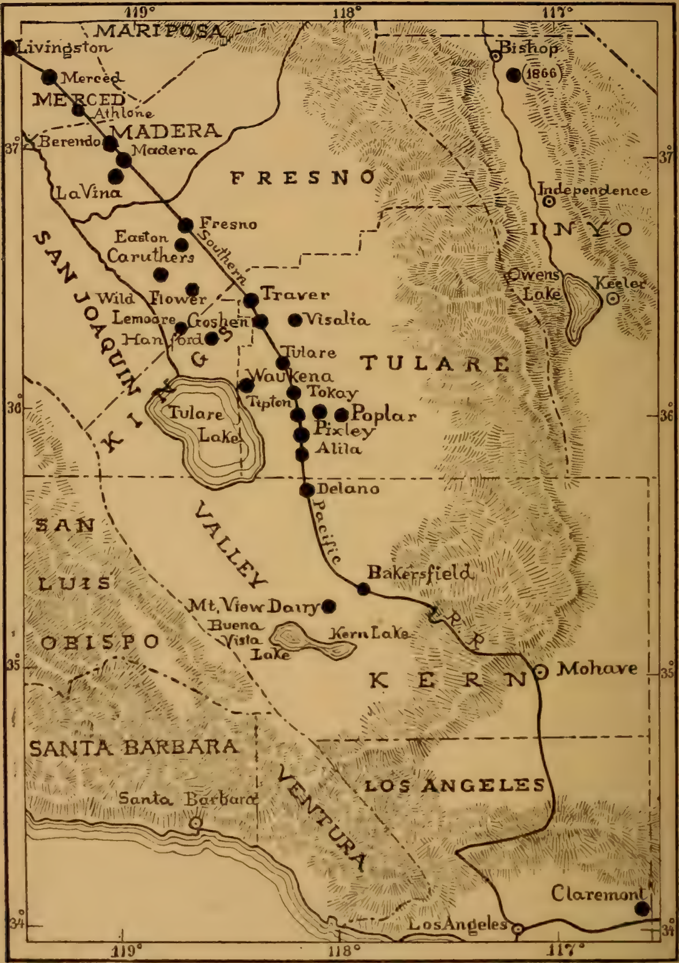
[1] The writer is indebted to many persons for aid in the preparation of the following list. Besides those named below should be mentioned Messrs. Charles H. Shinn, of Berkeley, Walter E. Bryant, of Oakland, and F. H. Holmes, of Berryessa, who have assisted in various ways.


119°
118°
117°
MARIPOSA
Livingston
Merced
MERCED
Athlone
MADERA
Berendo
Madera
La Vina
FRESNO
Bishop
(1866)
37°
Independence
INYO
Fresno
Southern
Easton
Caruthers
Traver
Wild Flower
Lemoore
Goshen
Visalia
Hanford
KINGS
Tulare
Waukena
TULARE
Owens Lake
Keeler
Tokay
Tipton
Tulare Lake
Poplar
Pixley
Alila
36°
SAN JOAQUIN
Delano
Pacific
VALLEY
SAN LUIS OBISPO
Bakersfield
R. R.
Mt. View Dairy
Buena Vista Lake
Kern Lake
KERN
Mohave
35°
SANTA BARBARA
Santa Barbara
VENTURA
LOS ANGELES
Claremont
Los Angeles
34°

MAP SHOWING LOCATION OF RABBIT DRIVES IN SOUTHERN CALIFORNIA.

Drives have occurred at each place marked with a black spot.

List of California Rabbit Drives.

Locality.	Date.	Rabbits killed.	Authority.
Fresno County.			
Caruthers (6 miles west)	Feb. 22, 1892	7,460	Alvah A. Eaton.
Easton (12 miles southwest of Fresno).	Feb. 13, 1892	[1]14,000	Weekly Fresno Expositor, Feb. 17, 1892; Forest and Stream, XXXVIII, Mar. 3, 1892, 197—15,000.
Do	Mar. 12, 1892	[2]20,000	Photograph by F. M. Stiffler, Oakland.
Do	Mar. 18, 1892	[3]2,000	Weekly Fresno Expositor, Mar. 22, 1892.
Fresno (5 miles south)	Mar. 16, 1888	1,500 900	Fresno Daily Republican, Mar. 17, 1888; Expositor, Mar. 22.
Do	Mar. 24, 1888	[4]14,723	Fresno Daily Republican, Mar 25, 1888.
Do	Apr. 12, 1888	300	Fresno Daily Republican, Apr. 13, 1888.
Do	Apr. 25, 1888	1,200	Fresno Expositor, Apr. 25, 1888.
Fresno (10 miles south)	Mar. 23, 1889	151	Fresno Daily Republican, Mar 24, 1889.
Fresno	Mar. 13, 1893	....	Photograph by E. R. Higgins, Fresno.
Do	Mar. 18, 1893	10,500	Chicago Daily News, May 10, 1893.
Do	May 5, 1894	1,000	Daily Evening Expositor, May 5, 1894.
Huron	July 12, 1891	2,500	Tulare County Times (Visalia), July 16, 1891.
Wild Flower	Mar. 14, 1888	....	Weekly Visalia Delta, Mar. 29, 1888.
Do	Mar. 1, 1889	[5]12,000	Scientific Am., LXI, Nov. 9, 1889, p. 295.
Kern County.			
Bakersfield	Jan. 2, 1888	[6]1,126 796	San Francisco Mining and Sci. Press, Jan. 28, 1888, p. 51.
Do	Jan. 10, 1888	[7]5,075 500	Do.
Do	Feb. 9, 1888	3,500	Weekly Kern County Echo, Feb. 16, 1888.
Bakersfield (Houghton dairy)	Oct. 1, 1888	[8]1,600	Weekly Kern County Echo, Oct. 8, 1888.
Bakersfield (4 miles west)	Jan. 20, 1889	200	Weekly Kern County Echo, Jan. 24, 1889.
Bakersfield (Rosedale, 3 miles north).	May 3, 1891	1,500	Weekly Kern County Echo, May 7, 1891.
Do	May 16, 1891	2,500	Weekly Kern County Echo, May 21, 1891.
Do	June 6, 1891	3,500	Gus. Kratzmer, Bakersfield.
Bakersfield (5 miles south)	June 10, 1894	1,000	Weekly Kern County Echo, June 14, 1894.
Bakersfield (6 miles southeast).	Dec. 9, 1894	350	C. A. Nelson, Bakersfield.
Do	Dec. 16, 1894	500	B. L. Brundage, Bakersfield.
Do	Dec. 23, 1894	200	Do.
Delano	Feb. 4, 1888	5,500	Delano Courier, Feb. 10, 1888.
Delano (10 miles southwest)	Feb. 19, 1888	5,500	Delano Courier, Feb. 24, 1888.
Delano (9 miles west)	July 13, 1888	10,000	Delano Courier, July 20, 1888.
Delano	Nov. 14–Dec. 31, 1894.	[9]25,000	Hill & Conrad, Delano.
Haggin & Carr Ranch, Kern Island.	1875	1,200	Geo. W. Stewart, editor Visalia Delta.
Mount View dairy[10] (13 miles southwest of Bakersfield).	Jan. 15, 1888	[11]3,500	Weekly Kern County Echo, Jan. 19, 1888.
Do	Jan. 23, 1888	2,000	Weekly Kern County Echo, Jan. 26, 1888.
Do	Jan. 30, 1888	5,000	Weekly Kern County Echo, Feb. 2, 1888.
Do	Feb. 5, 1888	5,000	Weekly Kern County Echo, Feb. 9, 1888
Mount View dairy[10] (13 miles southwest of Bakersfield) (shotgun drive).	Feb. 12, 1888	500	Weekly Kern County Echo, Feb. 16, 1888.
Mount View dairy[10] (13 miles southwest of Bakersfield).	Feb. 19, 1888	[12]7,000	Weekly Kern County Echo, Feb. 23, 1888.
Mount View dairy[10] (13 miles southwest of Bakersfield) (shotgun drive).	Feb. 25, 1888	1,000	Weekly Kern County Echo, Mar. 2, 1888.
Do	Mar. 4, 1888	1,946	Weekly Kern County Echo, Mar. 8, 1888.
Do	Mar. 3, 1889	4,428	Shooting and Fishing, V, Mar. 28, 1889, 13.

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[1] Actual count—7,000 in the corral, 7,000 dead outside.

[2] The great G. A. R. drive, which took place between Easton and Oleander; the largest drive on record. The Weekly Fresno Expositor of March 16, 1892, places the number of rabbits killed at 25,000.

[3] Badly managed; about 20,000 rabbits rounded up; all but 2,000 escaped.

[4] Two drives same day; 9,723 by actual count; about 4,000 hauled away before count began; 1,000 taken alive for Merced coursing match.

[5] Mr. M. S. Featherstone, of Goshen, states that only 8,000 were killed by actual count.

[6] 2,500 estimated to have been killed altogether.

[7] 500 estimated to have been killed outside the corral.

[8] Private drive, covering 16 sections.

[9] Thirteen private drives. About two-thirds of these rabbits were shipped to the San Francisco market.

[10] Returns for these drives vary. Messrs. Nelson & Bailey have circulated a clipping from the Kern County Echo with their photograph of the drive of March 4, 1888, which gives the following figures: January 2, 2,500; January 8, 6,000; January 15, 5,500; January 23, 2,000; January 30, 4,000; February 5, 5,000; February 9, 500; February 12, 4,500; February 19, 7,000; February 23, 1,500; March 4, 2,000.

[11] 3,000, according to N. E. White in American Field, XXX, November 3, 1888, 410–411.

[12] Actual count, first drive, 5,500; second, 1,500.

List of California Rabbit Drives—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Kings County.			
Hanford (shotgun drive)	Mar. 3, 1886	3,000 1,000	George W. Stewart, editor Visalia Delta.
Hanford (Cross Creek)	Mar. —, 1888	1,250	Weekly Visalia Delta, Mar. 29, 1888.
Hanford (Half way to Traver)	Apr. 22, 1888	[1]4,569	Weekly Visalia Delta, Apr. 26, 1888.
Los Angeles County.			
Claremont	Sept. 9, 1893	100	Pomona Times, Sept. 13, 1893.
Madera County.			
Berendo (Desmond Ranch)	Mar. or Apr., 1888.	5,000	H. D. Crow, Berendo.
Do	do	250	Do.
Berendo (Miller Ranch)	do	500	Do.
Berendo	Jan. or Apr., 1889.	400	John J. Purkner, Madera.
Berendo (Miller Ranch)	Feb. or Mar., 1892.	400	H. D. Crow, Berendo.
Berendo	1892		H. D. Crow and Miss L. K. Gozzoli, Berendo.
Do	Feb. 24, 1895	2,900	J. F. Ward, Berendo.
Do	Feb. 28, 1895	3,000	Do.
Do	Mar. 9, 1895	1,500–1,600	Do.
John Brown Colony	Apr. or May, 1890.		John J. Purkner, Madera.
Do	Spring, 1891	2,500	L. U. Hoskins, Madera.
Do	Spring, 1892	1,200	Do.
Do	Mar. —, 1893	1,400–1,500	Do.
La Vina	Apr. —, 1890	750	John J. Purkner, Madera.
Madera (4 miles west)	Dec. 30, 1888	400	Weekly Visalia Delta, Jan. 10, 1889.
Madera (5 miles south)	Feb. —, 1889	2,500	John J. Purkner, Madera.
Madera (3 miles west)	Mar. 14, 1889	1,050	J. F. Ward, Berendo.
Madera	Apr. —, 1889	1,000	John J. Purkner, Madera.
Madera (5 miles south)	May —, 1889	1,500	Do.
Madera (3 miles west)	Feb. 17, 1895	250	Do.
Merced County.			
Athlone (10 miles west)	Spring, 1888	1,200–1,500	W. H. Bowden, Athlone.
Do	do	1,200–1,500	Do.
Athlone (16 miles south)	do	1,200–1,500	Do.
Hartley Ranch (near Berendo, Madera County).	Mar. 16, 1895	200	J. F. Ward, Berendo.
Hartley Ranch ?	Feb. 8, 1895	2,100	Do.
Livingston	Apr. 4, 1893	8,000	F. Crowell, Livingston.
Do	Apr. or May, 1893.	2,500	Do.
Do	Apr. 25, 1893	1,000	Do.
Do	1893 ?	250	Diary of D. L. Heffner, Merced.
Do	Apr. 4, 1894	2,000	F. Crowell, Livingston.
Merced	Mar. 24, 1888	1,000	San Joaquin Valley Argus, Mar. 24, 1888.
Do	Mar. 28, 1888	2,000	San Joaquin Valley Argus, Mar. 31, 1888.
Do	Apr. 4, 1888	2,800	H. N. Wilson, Merced.
Do	Apr. 16, 1888	1,700	San Joaquin Valley Argus, Apr. 21, 1888.
Do	Mar. 12, 1889	2,000	San Joaquin Valley Argus, Mar. 16, 1889.
Modoc County.			
Cedarville (3–12 miles south)	June–July, 1893.	3,000	T. H. Johnston, Cedarville.
Cedarville (7 miles north)	Dec. 20, 1894	260	Do.
Lake City	Jan. 5, 1893	990	S. O. Cressler, Lake City.
Do	Jan. 15, 1893	500	Do.
Do	Jan. 20, 1893	250	Do.
Do	Jan. 25, 1893	345	Do.
Lake City (2 drives)	Feb. —, 1893	275	Do.
Lake City	Dec. 30, 1894	250	Do.
Do	Jan. 5, 1895	60	Do.
Do	Jan. 20, 1895	50	Do.
Likely (several drives)	1889		Wm. J. Dorris, Likely.
Tulare County.[2]			
Alila	Sept. 15, 1888	3,000	Delano Courier, Sept. 21, 1888.
Do	Sept. 22, 1888		Delano Courier, Sept. 22, 1888 (announced).
Goshen	1888	850	Shooting and Fishing, V, No. 13, Jan. 24, 1889, p. 10.
Do	Apr. 11, 1888	[3]994	Weekly Visalia Delta, Apr. 12, 1888.
Do	Jan. 20, 1889	1,200	Tulare Register, Feb. 1, 1889.
Do	Feb. 15, 1889	[4]2,500	M. S. Featherstone, Goshen.
Do	Mar. —, 1889	700	Weekly Visalia Delta, Mar. 21, 1889.

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[1] 3,969 in the corral, and 600 estimated to have been killed outside, all on one section of land.

[2] Mr. D. K. Zumwalt, of Visalia, has kindly furnished the statistics for 16 drives in this county, and several in Fresno, Kern, and Kings counties.

[3] About 200 more were killed outside; a second drive was made later, but the figures were not given.

[4] 2,390 actually driven into the corral; the others killed outside.

List of California Rabbit Drives—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Tulare County—Continued.			
Jonesa	Apr. 9, 1888	4,000	Weekly Visalia Delta, Apr. 26, 1888.
Oakdale	Mar. 18, 1888	[1] 2,200	Weekly Visalia Delta, Mar. 29, 1888.
Oakdale (3 miles south)	Mar. 24, 1888[2]	1,211	Do.
Pixley	Nov. 14, 1887	[3] 2,000	Tulare Register, Nov. 18, 1887.
Do	Dec. 3, 1887	1,000	Tulare Register, Dec. 9, 1887.
Do	March, 1888	1,300	Samuel Shilling, Pixley.
Do	June 1, 1888	8,000–10,000	John W. Harper, Pixley.
Pixley (12 miles south)	May —, 1889	1,000	Samuel Shilling, Pixley.
Pixley	Aug. 20, 1893	300–400	John W. Harper, Pixley.
Do	Nov. (7?), 1894	3,900	Maj. C. J. Berry, Visalia.
Do	Dec. 14, 1894	200	John W. Harper, Pixley; G. J. Martin, Poplar—290.
Pixley (other drives[4])	....	3,000–4,000	John W. Harper, Pixley.
Plano (18 miles west)		....	William Thomson, Plano.
Poplar	Jan. 20, 1895	145	G. J. Martin, Poplar.
Do	Jan. 27, 1895	235	Do.
Tipton (Lake View school)	Jan. 28, 1888	420	W. J. Browning, Tipton.
Tipton	May 18, 1889	117	Tulare Register, May 24, 1889.
Tokay (5 miles south Tulare)	Mar. 10, 1888	2,500	Tulare Register, Mar. 16, 1888.
Tokay	Feb. 25, 1890	....	M. S. Featherstone, Goshen.
Traver (Settlers ditch, southwest of town).	Apr. 7, 1888[5]	1,000	Weekly Visalia Delta, Apr. 12, 1888.
Traver	Feb. 26, 1889	1,200	Fresno Daily Republican, Mar. 2, 1889.
Do	Mar. 8, 1889	....	Fresno Daily Republican, Mar. 10, 1889.
Do	Apr. —, 1891	1,500	Henry Lahann, Traver.
Do	do	500	Do.
Do	Mar. 6, 1892[6]	4,000	Los Angeles Times, Mar. 7, 1892.
Do	Apr. 8, 1892	4,000	C. S. Greene, Overland Monthly, 2d ser., XX, July, 1892, pp. 49–58.
Do	Feb. – Apr., 1892.	12,000	4 drives,[7] Henry Lahann, Traver.
Do	Apr. 8, 1893	2,500	Henry Lahann, Traver.
Do	Feb. 25, 1894	2,000	Do.
Do	Mar. 4, 1894	1,500	Do.
Do	Apr. 7, 1894	2,000	Visalia (Tulare County) Times, Apr. 12, 1894.
Traver (10 miles southwest)	Mar. 31, 1895	370	S. S. Cederberg, Hanford.
Traver	Apr. 8, 1895	300	Henry Lahann, Traver.
Tulare (Mitchell Ranch, 6 miles west).	Feb. 11, 1888	[8] 5,000	Weekly Visalia Delta, Feb. 16, 1888.
Tulare (Birch Ranch, 7 miles west).	Feb. 15, 1888?	2,500	Photograph from D. K. Zumwalt, Visalia.
Tulare (7 miles south)	Feb. 20, 1888	1,000	Tulare Register, Feb. 24, 1888.
Tulare	Feb. 24, 1888	2,300	Weekly Visalia Delta, Mar. 1, 1888.
Do	Mar. 2, 1888	3,000	Tulare Register, Mar. 2, 1888.
Tulare (6 miles east)	Mar. 4, 1888	2,232	Tulare Register, Mar. 9, 1888.
Tulare	Mar. 9, 1888	2,000	Tulare Register, Mar. 16, 1888.
Tulare (Parkwood, 7 miles northwest).	Mar. 24, 1888	2,200	Tulare Register, Mar. 30, 1888.
Tulare	Feb. 9, 1889	1,400	Tulare Register, Feb. 10, 1889.
Do	Feb. 25, 1889	350	Tulare Register, Feb. 28, 1889.
Do	Mar. 30, 1889	200	Tulare Register, Apr. 5, 1889.
Tulare (Mitchell Ranch, 6 miles west).	Feb. —, 1890	....	M. S. Featherstone, Goshen.
Visalia	Mar. 16, 1888	3,300	Weekly Visalia Delta, Mar. 29, 1888.
Visalia (north of town)	Mar. 18, 1888	1,400	Do.
Visalia (?) (McCann Ranch)	Apr. 14, 1888	400	Weekly Visalia Delta, Apr. 19, 1888.
Waukena	Feb. 11, 1888	5,000	Weekly Visalia Delta, Feb. 16, 1888.
Do	Feb. 2, 1889	1,067	Weekly Visalia Delta, Feb. 7, 1889.
Do	June 11, 1894	500	W. F. Glass, Waukena.
Do	June 30, 1894	500	Do.
Do	Nov. 16, 1894	150	Do.

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[1] 300–400 more probably killed before reaching the corral.
[2] Another drive announced for March 29, 1888.
[3] First public drive in California.
[4] Several small shotgun drives took place about 1882 and 1883.—J. Ellis McLellan.
[5] Another drive announced for April 15, 1888.
[6] Third drive of the season. Another was planned for March 13, 1892, but no report has been received.
[7] Six drives in all took place during February, March, and April, in which 20,000 were killed.
[8] About 1,000 more estimated to have escaped. Another drive planned for March 18.

RESULTS OF THE DRIVES.

Although it is practically impossible to give all the rabbit drives which have occurred in California during the last eight years, still this list of 155 drives, including the more important ones during the twenty years from 1875 to 1895, should be sufficient to show the progress of rabbit driving and the effect of this means of extermination. The general results may be tabulated as follows:

Summary of California Rabbit Drives.

	Before 1888.	1888.	1889.	*1890.	1891.	1892.	1893.	1894.	1895.	Misc.	Total.
Number of drives..	4	55	20	1	7	12	15	29	12	....	155
Rabbits killed......	8,200	158,492	34,963	750	14,500	65,060	32,010	41,310	11,160	3,750	370,195
Average number per drive..........	2,050	2,881	1,748	....	2,071	5,421	2,134	1,424	930	....	2,387

* Returns incomplete; 4 drives reported but figures given for only 1.

An examination of these figures shows that in the total of 155 drives 370,195 rabbits were killed, or an average of nearly 2,400 in each drive. Returns for years previous to 1888 have been received for only 4 drives in which 8,200 rabbits were killed, but during the spring of 1888 the number of drives suddenly increased to 55, and then, as the novelty wore off or the rabbits became scarcer, decreased to 7. During the same period the number of rabbits slaughtered decreased from nearly 160,000 in 1888 to 14,500 in 1891. In 1892 there were a few more drives and a decided increase in the slaughter of rabbits, due to the large drives in Fresno County. The total of 65,060 rabbits was second only to that of the season of 1888, but in the last three years there has been a decided falling off in the totals. The apparent increase in the number of drives in 1893 and 1894 is due in part to the small hunts in Modoc County, but the number in the San Joaquin Valley has continued to decline regularly until 1895, when only 12 small drives were reported.

The largest number of rabbits killed in any single drive is said to have been 20,000, but the average of all the drives for any one year has varied from 5,400 down to 930 the past season. By far the greater number have been killed in the southern part of the San Joaquin Valley in a strip about 170 miles in length and 30 miles in width. If the small drives in the northern part of the State and the single one in Los Angeles County are omitted, as well as the two early shotgun drives, the result is reduced to about 356,400 rabbits killed in 140 drives during eight years, or an average annual slaughter of about 44,500 rabbits in an area scarcely as large as the States of Connecticut and Rhode Island combined. The success of the drives is evident from the small number of rabbits killed during the last three years. This result, at least in Fresno County, is probably due in part to the appearance of an epidemic among the jack rabbits soon after the large drives of 1892. One correspondent writes from Selma: "Just as it had been found possible to control their presence in the more thickly settled part [of Fresno County] an epidemic appeared among them and they died by hundreds and by thousands. * * * Since then we have kept a few dogs and the wire-screen fences have been gradually taken down, and now very few rabbits are to be found among the vines."

Whether the present diminution in numbers is only temporary remains to be seen, but this section of California is now being settled so fast that it seems hardly possible for the rabbits to increase to their former abundance under all the forms of destruction which can be used against them. The case is instructive in showing the combined effect of natural and other means of extermination. If rabbits could be systematically destroyed just after their numbers had been reduced by an epidemic, they would receive a setback from which they would not soon recover.

The decline of rabbit driving is hardly to be deplored. In the San Joaquin Valley a drive was made the occasion of a general holiday; the schools were closed and women and children joined the throng to assist in clubbing the rabbits or to watch the slaughter. It may be questioned whether such frequent scenes of butchery can have anything but an injurious effect on a community, and it is fortunate that the necessity for them does not now exist.

OREGON.

In Oregon the California method of destroying rabbits by drives has been recently introduced. Throughout the region east of the Cascades the black-tailed Texan Jack Rabbit (*Lepus texianus*) is very abundant and has become so troublesome in Lake County that $2,160 was expended for its destruction during the years 1888, 1889, and 1890. More than a dozen drives were made in December 1894, and January 1895, in the vicinity of Lakeview. In one of these, which took place on January 6, 1,975 rabbits were killed, while the total number slaughtered during the two months amounted to 12,202. Several drives, resulting in the destruction of 3,000 to 4,000 rabbits, have occurred during the winter of 1895–96, but in the absence of any detailed report they have not been included in the following table.

Partial List of Rabbit Drives in Oregon.

Locality.	Date.	Rabbits killed.	Authority.
Lake County.			
Lakeview	Dec. 18, 1894	1,654	C. U. Snider, Lakeview, Oreg.
Do	Dec. 20, 1894	1,767	Do.
Do	Dec. 22, 1894	685	Do.
Do	Dec. 24, 1894	826	Do.
Do	Dec. 27, 1894	1,592	Do.
Do	Dec. 30, 1894	300	Do.
Do	Jan. 3, 1895	973	Do.
Do	Jan. 6, 1895	1,975	Do.
Do	Jan. 10, 1895	1,146	Do.
Do	Jan. 17, 1895	304	Do.
Do	Jan. 20, 1895	200	Do.
Do	Jan. 24, 1895	280	Do.
Do	Other drives	500	Do.
Total (12 drives)		12,202	
Average		1,016	

RABBIT HUNTS.

It may be of interest to consider the methods of destruction which have been used in other States. Two of the jack rabbits which occur in California (*Lepus texianus* and *L. campestris*) are common also in Utah, Idaho, and Colorado, and in some sections are excessively abundant. An entirely different method of extermination, however, is practiced from that adopted in California. Large numbers are killed with shotguns in regularly organized hunts, but rabbit drives, properly speaking, are now rarely made, except in Idaho.

UTAH.

According to Mr. M. Richards, jr., of Parowan, Utah, the club was formerly used in some of the rabbit hunts on the brush lands bordering Little Salt Lake, and as many as 2,000 rabbits have been killed in a drive, but this method has now been abandoned and shooting has been adopted instead.

Rabbit hunts have taken place since the earliest settlement of the State—nearly half a century ago—but when they were first held by the Indians is unknown. The Piutes, Goshutes, and Pahvan Indians were accustomed to resort to a large valley near Cedar City during the month of November, for the purpose of having a grand hunt, and thousands of rabbits were annually slaughtered.[1] Strangely enough, the first hunt among the whites of which we have any record probably occurred very near this place, and was participated in by a party of emigrants on their way from Salt Lake City to California in 1849. It was a portion of the same company which soon after experienced such hardships on the desert, and on account of whose sufferings the now celebrated Death Valley in California received its name. This early rabbit hunt probably took place in the month of October, 1849, somewhere in the region north of Little Salt Lake, either in Iron or Beaver County. Mr. W. L. Manly,[2] one of the members of the party, describes the hunt as follows:

"We came into a long, narrow valley well covered with sage brush, and before we had gone very far we discovered that this was a great place for long-eared rabbits—we would call them jack rabbits now. Everyone who had a gun put it into service on this occasion, and there was much popping and shooting on every side. Great clouds of smoke rolled up as the hunters advanced, and the rabbits ran in every direction to get away. Many ran right among the horses, and under the feet of the cattle and under the wagons, so that the teamsters even killed some with a whip. At the end of the valley we went into camp, and on counting up the game found we had over 500, or about one for every person in camp."

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[1] Coues & Yarrow, Rept. Geog. Surv. W. 100th Merid., V, Zool., 1875, p. 127.

[2] Death Valley in '49, 1894, pp. 110–111.

Mr. James L. Bunting, of Kanab, writes that between 1858 and 1870 rabbits were very abundant on the land between the Jordan River and Great Salt Lake. In November and December hunters would go out almost daily in parties of from four to six each, and on some occasions as many as 500 rabbits were killed in a single day.

The hunts usually take place in the winter or early spring when the snow is on the ground, and are thus described by W. G. Nowers in a letter dated February, 1887. He says:

"Our mode of destroying these pests is to select two captains, who choose their associates from the community, and form two attacking parties, who ride or go with firearms, dogs, clubs, and so on, and lay siege to every rabbit caught sight of. In some instances the slaughter has amounted to nearly 1,000 for each side. These raids are waged on every favorable opportunity—after a snowstorm, or monthly, if no snow falls, as has been the case this winter."

Rabbit hunts have occurred in a number of places in southwestern Utah, but are less common in the northern part of the State. One, however, took place near Corinne during the summer of 1894. According to Prof. Marcus E. Jones, as many as a dozen or fifteen hunts have occurred annually during recent years. One of the largest is described by Mr. Vernon Bailey as having taken place near Panguitch, Garfield County, in 1885. It lasted three days, and some 80 men and boys took part, killing more than 5,000 rabbits within a few miles of the town. As will be seen from the following table, the recent Utah hunts are small in comparison with those in Colorado or the California drives.

Partial List of Rabbit Hunts in Utah.

Locality.	Date.	Rabbits killed.	Authority.
Beaver County.			
Beaver	Dec., 1886	5,000	Orson Alred, Beaver.
Do	1894	1,600	Do.
Do	Feb., 1895	2,300	Do.
Minersville[*]	July, 1887	2,000-3,000	Dotson & Son, Minersville.
Do	Dec., 1887, or Jan., 1888.	1,500-2,000	Do.
Boxelder County.[†]			
Corinne	Summer 1894	300–400	Editor Bugler, Brigham City.
Kelton		1,000	Conant Bros., Kelton.
Garfield County.			
Panguitch	1885	5,522	David W. Montague, Panguitch.
Iron County.[‡]			
Near Little Salt Lake ?	Oct. (?), 1849	500	W. L. Manly, 'Death Valley in '49', 110.
Cedar City	Feb. 24, 1894	527	Will C. Higgins, Cedar City.
Kanarraville	Dec. 21, 1893	172	Do.
Do	Jan. 28–Feb. 2, 1895.	169	Iron County Record Feb. 8, 1895.
Paragonah	Feb. 11–14, 1895	600	Iron County Record Feb. 15, 1895.
Parowan	Spring 1875	2,000	M. Richards, jr., Parowan. (Drive).
Do	Spring 1885	1,800	Do.
Do	Jan. 18, 1894	796	Will C. Higgins, Cedar City.
Do	Jan. 31, 1894	337	Do.
Summit	Jan. 20–26, 1895	1,290	Iron County Record Feb. 1, 1895.

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[*] Messrs. Dotson & Son report that 21,000–22,000 rabbits were killed in two months in 1887 and 1888.

[†] A number of hunts seem to have occurred near Brigham City and elsewhere, which are necessarily omitted here in the absence of sufficient data. The county paid bounties on 12,758 rabbits during the years 1893, 1894, and 1895—see p. 43.

[‡] Mr. M. Richards, jr., of Parowan gives 9,000 as the probable number of rabbits killed in this county during 1894.

Partial lists of Rabbit Hunts in Utah—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Millard County.			
Corn Creek	Mar. 27, 1894	50-60	Marcus E. Jones, Salt Lake City.
Kanosh	Jan. —, 1893	1,800	James A. George, Kanosh.
Do	Jan. (19?), 1894	1,000	Do.
Sanpete County.			
Mount Pleasant	Dec. 30, 1894 to Jan. 12, 1895.	1,000	Several hunts. Postmaster.
Wayne County.			
Loa	Dec. 14, 1894	350	John T. Lazenby, Loa.
Central Utah	Dec. 3, 1893	2,762	John L. May, Salt Lake City.
Do	Nov. 29, 1894	1,379	Do.
Do	Dec. 8, 1894	656	Do.
Total (26 hunts)		37,215	

IDAHO.

A few large hunts have recently occurred in southern Idaho, but greater success has attended the introduction of the rabbit drive. A novel method is sometimes employed in Fremont County, the rabbits being baited by spreading a line of hay on the snow or on the ground, and after they are 'lined up' several can be killed at a single shot.

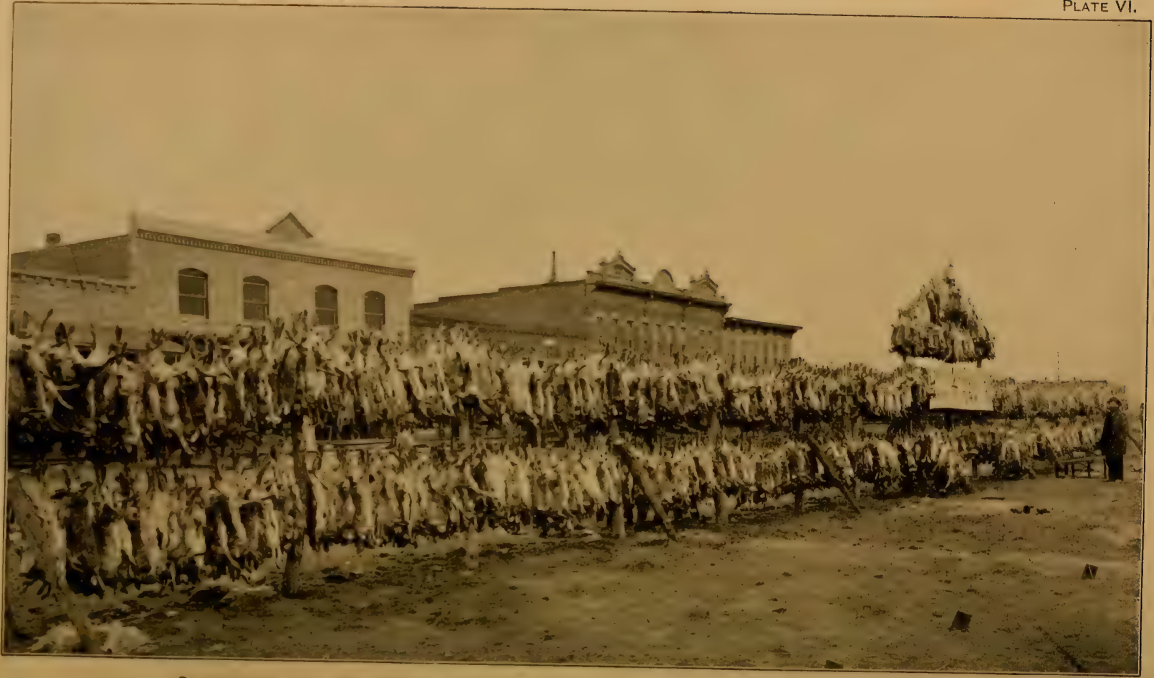
Mr. T. T. Rutledge, assistant director of the experiment station at Nampa, Canyon County, reports that a small hunt took place about September 1894, near that place, but the number killed is unknown. In the winter of 1894–95 about 2,600 jack rabbits were killed near Idaho Falls, Bingham County, and shipped to Eustice, Nebr., along with grain and provisions for distribution among the drought sufferers in that State. Another smaller hunt also occurred at Idaho Falls later on.

While these pages are passing through the press, reports have been received indicating that rabbit driving is being successfully carried on in the southern part of the State. At Marion, Cassia County, about 5,000 rabbits were killed in a drive on December 9, 1895. It was estimated that 500 people were present and that an area of country less than 3 miles square was driven over; 4,000 more rabbits were killed at the same place during the following week.

Farther east two smaller drives were held at Market Lake, Fremont County. In this case no corrals were built, the rabbits being simply driven into the railroad stock yards and afterwards shipped to Salt Lake City for distribution among the poor. The following list has been brought down to date as far as possible and includes five drives which occurred early in January, 1896:

Partial List of Idaho Rabbit Drives and Hunts.

Locality.	Date.	Rabbits killed.	Authority.
Bingham County.			
Idaho Falls	Winter 1894–95.	2,600	A. V. Scott, Idaho Falls.
Do	do		Do.
Canyon County.			
Nampa	Sept. —, 1894		T. T. Rutledge, Nampa.



RESULT OF THE JACK RABBIT HUNT AT LAMAR, COLORADO, DECEMBER 22, 1894—5,142 RABBITS KILLED.
(From photograph by Hallack.)

Partial List of Idaho Rabbit Drives and Hunts—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Cassia County.			
Marion*	Dec. 7, 1895	5,000	C. A. Tolman, Marion.
Do	Dec. 9, 1895	2,000	Do.
Do	Dec. 14, 1895	2,000	Do.
Do	Dec. 31, 1895	1,200	Do.
Do	Jan. 3, 1896	150	Do.
Do	Jan. 4, 1896	1,600	Do.
Fremont County.			
Grant †	Feb. 1, 1895	247	Eli McEntire, Grant.
Do	Feb. 7, 1895	450	Do.
Do	Feb. 14, 1895	509	Do.
Do	Feb, 20, 1895	739	Do.
Lewisville	Jan. 9, 1896	990	Ed Ellsworth, Lewisville.
Market Lake*	Dec. 30, 1895	1,044	Do.
Do	Jan. 4, 1896	1,000	Do.
Rigby	Winter 1894–95.	2,000	E. P. Coltman, Idaho Falls.
Do*	Jan. 11, 1896	300	Ed Ellsworth, Lewisville.

* Drives.

† Hunts have been reported from Lewisville for February 14 and 26 (?), 1895, which are probably the same as those given in this list. Grant, Lewisville, and Rigby are all within a few miles of one another; the same hunt may be reported from different places and thus lead to confusion, particularly if no dates are given.

COLORADO.

During the last three years a series of rabbit hunts have taken place in eastern Colorado, resulting in the destruction of nearly 29,000 rabbits. As is the case with the hunts in Utah, no inclosures are built and shotguns are the only weapons used. The hunters are usually distributed over the ranches in the neighborhood and hunt singly or in small parties. The success of these hunts has led to the celebration each winter of a 'Rabbit Day,' which is set apart for the destruction of the pests. In reply to an inquiry concerning the origin of the custom at Lamar, Mr. J. T. Lawless, editor of the Lamar Sparks, wrote on March 4, 1895:

> This portion of Colorado was first settled in 1886, and in 1889 farming by irrigation was begun on an extensive scale. The territory under ditch is about 18 miles wide. North and south of this strip of irrigated land there is little vegetation, and the land is valuable chiefly as a stock range. After the first year of farming by irrigation, rabbits increased rapidly, and the farmers were greatly annoyed. The rabbits came from the rainbelt region for miles around and made their headquarters in the alfalfa and grain fields and the growing orchards of Prowers County. * * * The great increase in the number of rabbits caused much concern, and finally a big hunt was arranged to reduce their numbers. This hunt was confined to people of Lamar and the county. About fifty-five men participated, and they killed over 1,200 rabbits in one day. The following winter another hunt was arranged on similar lines, and the same number of men brought in about 2,000 rabbits. This hunt was followed by the first annual hunt, in which gunners from all parts of the State participated. That was the inauguration of Rabbit Day. Over 4,000 rabbits were killed, and these were drawn and shipped to Denver and Pueblo for distribution among the poor, to whom the meat was very acceptable.

One of the largest and most successful hunts was that of December 22, 1894, in which 101 gunners took part and secured 5,142 rabbits as the result of a day and a half of steady work (see Plate VI). When dressed, these jack rabbits usually average about 6½ pounds each, and it was estimated that the game obtained in this hunt weighed nearly 5 tons. The annual hunt on December 19-20, 1895, was less successful, owing to a severe storm and deep snow; only about 1,600 rabbits were killed.

A unique feature of the Colorado hunts is the disposition of the game, which is distributed among the poor of Denver and Pueblo. The rabbits are transported free of charge by the railroads and distributed mainly under the direction of Rev. Thos. A. Uzzell, of Denver. This charitable work was begun about four years ago, and 250 jack rabbits were received the first winter; last season 4,500 were distributed in Denver alone, and it is said that over 5,000 have been given away each season for the last three years. In fact the success of the hunts at Lamar in December, 1893, January and December, 1894, was largely due to the efforts of Rev. Thos. A. Uzzell, who arranged for the shipment and distribution of the rabbits.

List of Colorado Rabbit Hunts.[*]

Locality.	Date.	Rabbits killed.	Authority.
Brush, Morgan County	Dec. 28, 1894	700	Lamar Sparks, Jan. 3, 1895.
Lamar, Prowers County	Jan. 6, 1893	1,194	A. Van Deusen, Lamar.
Do	Dec. 22, 1893	1,799	Do.
Do	Jan. —, 1894	3,029	Do.
Do	Jan. 12-13, 1894.	4,500	Do.
Do	Nov. 25-26, 1894.	1,500	Do.
Do	Dec. 22, 1894	5,142	Do.
Do	Dec. 19-20, 1895.	1,600	Lamar Sparks, Dec. 26, 1895.
Las Animas, Bent County	Feb. 22, 1893	815	M. R. McCauley, Las Animas.
Do	Feb. 22, 1894	1,866	Do.
Do	Feb. 6-7, 1895	6,522	Jacob Weil and M. R. McCauley.
Total (11 hunts)		28,666	

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[*] For descriptions of the hunts of December, 1893, and January, 1894, see Shooting and Fishing, Vol. XV, January 4, 1894, p. 221, February 1, 1894, p. 303, and American Field, Vol. XLI, March 10, 1894, p. 222. For annual hunt of Dec. 19-20, 1895, see Shooting and Fishing, Vol. XIX, Jan. 2, 1896, p. 225.

SUMMARY.

A comparison of the foregoing tables will show that California has accomplished much more in the way of rabbit destruction than Colorado, Idaho, Oregon, or Utah, notwithstanding the fact that hunts have been held in Utah for nearly half a century. Rabbit driving is now on the decline in California, but the number of hunts is rapidly increasing in the other States. The results may be tabulated as follows:

General Summary of 220 Jack Rabbit Drives and Hunts in the West.

	California, 1875–1895.	Oregon, 1894–95.	Utah, 1849–1895.	Idaho, 1894–96.	Colorado, 1893–95.	Total.
Number drives	[*]155	[*]12	[‡]26	[‡]16	[†]11	220
Total number rabbits killed	370,195	12,202	37,215	21,829	28,666	470,107
Average number per drive	2,387	1,016	1,431	1,364	2,606	2,137
Largest drives	20,000	2,000	5,500	5,000	6,500	

[*] Drives. [†] Hunts. [‡] Both drives and hunts.

CHAPTER VI.

VALUE OF THE JACK RABBIT.

The question may well be asked whether the jack rabbit has any value or can be utilized in any way. In 1890 the Royal Commission of New South Wales suggested that "rabbits may be used for food, either fresh, frozen, canned, jerked, or as soup; for their skins and fur in the manufacture of gloves and felt; for extracting glue and oil; and for reduction to manure."[1] Nevertheless they discouraged the principle of commercial utilization on the ground that it would lead to the preservation of the rabbits instead of their destruction. But after many experiments with poisons, diseases, traps, and other methods of destruction, and an outlay of millions of dollars for fences, this very method has recently been advocated as the most promising, by the Hon. J. H. Carruthers, Minister for Lands in New South Wales. In his opening address to the rabbit conference, held at Sydney on April 2, 1895, he said:

> One feature of the rabbit question has not, it is thought, received sufficient attention at the hands of the sufferers in this colony, and that is the commercial utilization of the animal. In the past suggestions of this character have met with condemnation on the ground that it would lead to the conservation of the rabbit, but it would appear that the time for such argument has disappeared. Experience in the past leads to the belief that the rabbit is a fixture, and there should be no reason why persons resident in localities suitable for the purpose should not seriously consider why the animal should not be made to contribute to the cost of its own destruction. It is, of course, apparent that operations of this character would only be possible over a limited area of the infested country; but with the easy means of reaching foreign markets, it is worthy of consideration whether the carcass of the rabbit may not be used as an article of food, either frozen or canned, and whether the skins and fur may not be profitably applied in the manufacture of gloves and felt.[2]

In this country, however, the larger hares have been used in only a few of the ways suggested by the Royal Commission of New South Wales, viz, (1) for sport, especially in coursing, (2) for their skins, and (3) for food.

The pursuit of the jack rabbit furnishes excellent sport with the shotgun or rifle as well as to the mounted rider eager for a trial of speed with hounds. It is often a difficult matter to get a shot if the rabbit happens to be somewhat wary, but on the other hand, if the game is abundant and not too shy, large numbers may be readily killed.

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[1] Final Rept. Royal Com. Inquiry Exterm. Rabbits, Australasia, 1890, p. 4.

[2] Rept. Proceedings Conference Rabbit Pest, New South Wales, Sydney, 1895, p. 7.

In one of the large Colorado hunts, which are conducted mainly for sport, two men shooting together at Lamar, in December 1894, secured 412 rabbits in two days. For the rifle, a jack rabbit on the run makes a fine target, and one requiring skill and steadiness to hit. Hunting on horseback with shotguns is considered much more exciting than on foot and requires considerable skill in riding as well as in shooting. Hunting the jack rabbit with hounds, however, is a form of sport which seems to be increasing in popular favor, notwithstanding the fact that it is considered cruel by some.

COURSING.

The adaptability of the large hares for coursing has long been recognized. They are certainly superior in speed to any of the smaller rabbits, but whether they are better than the Old World Hare is still an open question. Thus far the evidence seems to be in favor of the jack. Says Van Dyke[1] in speaking of coursing in California:

> A dash after the hare on a good horse and behind good dogs is one of the most charming of outings. The horse enjoys the sport as well as the dogs do, and tries his best to outrun the procession. The ground flies beneath you, the surrounding mountains swim in a haze, the whole amphitheater seems to turn around while you are standing still. Vainly the hare twists and sends the dogs spinning ahead in confusion, while he scuds away on his new tack without the loss of an instant, so far as you can see. All ordinary dogs fall out of the race. Even the wiry and swift coyote, though he loves hare more than anything else, rarely if ever feels hungry enough for a stern chase. But if the greyhounds are good and the brush not too near, the hare's doubling only postpones his end, however untiring his foot, or frequent his twists. Vainly he lays his ears flatter upon his neck and lets out another link of his reserved speed. Before he has made many turns he is caught—perhaps in mid-air—and the dogs and hare go rolling over in a heap together.

Coursing began in California in the early sixties, and has since been carried on with more or less spirit by various clubs. About twenty years ago the old Los Angeles Coursing Club used to follow the jack rabbits with greyhounds on the mesa near Pasadena, and women as well as men took part in the sport.[2] In 1872 the Pioneer Coursing Club of San Francisco held the first of a series of meetings at Merced. Since 1890 the meetings of the Interstate Coursing Club have been held at this place, which has become one of the principal coursing centers on the Pacific Coast. Other meetings have been held at Newark, San Francisco, and near Los Angeles.

The American Coursing Club was the first club east of the Rocky Mountains to use jack rabbits, and in October, 1886, inaugurated a series of annual meetings which were continued up to 1892 on the Cheyenne bottoms, near Great Bend, Kans. In 1894 and 1895 the club met at Huron, S. Dak. The National Coursing Association, of Hutchinson, Kans., was organized in 1888, with a capital stock of $50,000, and flourished for two or three years. Its object was to develop coursing in the United States, by breeding rabbits on their own soil and shipping them to various parts of the country in order that meetings might be held in the large cities and a more general interest aroused.[1] The association had 320 acres at Hutchinson inclosed with a wire mesh fence, and imported jack rabbits from California, New Mexico, and Wyoming and turned them loose in this park where in a few months a large number were collected. 'Inclosed coursing,' i. e. running the rabbits in an inclosure instead of on the open plain, was introduced at the meeting, held on October 23, 1888. A track half a mile long and 75 yards wide was arranged inside the park. The rabbits were started at one end of the track and at the other were allowed to escape from the hounds, through small openings, into a pen, where they were caught for use in another race.[2] The National Coursing Association held meetings in 1889 at St. Louis, Mo., and Louisville, Ky., and fifty jack rabbits were shipped from the park at Hutchinson to be used in the latter meeting. In 1890 it held a series of meetings at St. Louis, Kansas City, and St. Joseph, Mo.; Colorado Springs and Denver, Colo.; Omaha and Lincoln, Nebr., and Council Bluffs, Iowa.

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[1] The Land of Sunshine, Los Angeles, Cal., III, Aug. 1895, pp. 116–117.

[2] Forest and Stream, XXVIII, Jan. 27, 1887, p. 3.

Coursing has received a wonderful impetus in the West during the last ten years largely through the work of these two clubs, the Interstate Coursing Club of Merced, Cal., and the Occidental Club of Newark, Cal. Since 1890 numerous local clubs have been organized in Montana, South Dakota, Nebraska, Kansas, Texas, Colorado, and southern California, and no small number of rabbits are required annually for these meetings.

The demand for rabbits for this sport seems to have been largely instrumental in bringing about the rabbit drives in California, and as many as a thousand or more have been obtained in one of the large drives. Nearly all the rabbits for coursing in this State come from the San Joaquin Valley. Some of them are caught near Goshen, where they are shipped in coops, containing 24 single stalls arranged in two rows. From 50 to 100 are sometimes required for a single meeting, and the wholesale price varies from $5.50 to $9 per dozen.

At Wichita, Kans., and Merced, Cal., several persons regularly trap rabbits for coursing. At Wichita, Mr. Chas. Payne captures jack rabbits by means of a net about a mile in length, made of common cotton seine twine, which is stretched straight across a field. On one side are attached short nets at an angle with the main net, forming a number of V's. The rabbits are driven toward the trap by 6 to 10 men on horseback, and 10 to 20 rabbits are considered a good catch for one day. Shipping boxes are so arranged that each animal is in a separate compartment, and the largest hold about a dozen rabbits. Some of these jack rabbits bring $2 apiece, and they have been shipped to various points in the United States and Canada, and even to England. Last winter (1894–95), between 200 and 300 were furnished to the St. Louis Coursing Association alone.

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[1] Am. Field, XXX, Nov. 24, 1888, p. 504.

[2] See illustrated article on "Jack Rabbits and Inclosed Coursing," by M. E. Allison, in Am. Field, XXXIII, Apr. 26, 1890, pp. 395–396.

SKINS.

Rabbit skins are used in greater quantities than those of any other animals except the true fur-bearing mammals. At present skins of jack rabbits have little commercial value, and no attempt appears to be made to utilize them on a large scale. It seems strange that where the animals are slaughtered in such numbers the skins are not made to yield a fair profit, as is done with those of other species. Their use for fur seems to be restricted mainly to the Indians.

The Piutes and other tribes of the Great Basin formerly relied to a considerable extent on the rabbit for furnishing their scanty supply of clothing, and in Idaho, Nevada, and Utah killed large numbers of jack rabbits for this purpose.

Says Bancroft in speaking of the Indians of this region: "On the barren plains of Nevada, where there is no large game, the rabbit furnishes the only clothing. The skins are sewn together in the form of a cloak, which is thrown over the shoulders, or tied about the body with thongs of the same. In warm weather, or when they can not obtain rabbit skins, men, women, and children are, for the most part, in a state of nudity." (Native Races of the Pacific States, I, 1874, pp. 423–424.)

Mr. Vernon Bailey, chief field naturalist of the division, who has traveled extensively in this region and seen the robes in use among the Indians, has kindly contributed the following notes:

> A good robe serves an Indian both for clothing and for bedding. It is exceedingly light, soft, and warm, and is easily carried in a small roll on the horse or in the pack when not in use. A Piute with an old shirt, a pair of breeches, moccasins, and one of these robes is well equipped for traveling, even in cold weather. In the wickiup the robe is thrown down and serves as a seat during the day and for a bed at night.
>
> Robes of jack rabbit skins are common articles of clothing among the Piute and Mohave Indians. I have seen them among the Pyramid Lake Indians, the Piutes in Reese River Valley, Nevada, and the Mohaves at Fort Mohave, Ariz. They are usually 6 or 7 feet square, large enough to wrap around the body and entirely cover the person. They are made of twisted strips of jack rabbit skins laid parallel close together and fastened at short intervals with strings. The skins, apparently, are not tanned, but the robes are as soft and pliable as a blanket, and by twisting the strips the fur is thrown on both sides. These robes are generally valued at $6 to $8, but the Indians seem reluctant to part with them. One old Mohave upon being asked to sell his robe, refused, saying: "Me no make 'em. Hualapai make 'em, me buy 'em."

Jack rabbits were doubtless used also by the Indians of California, although to a less extent. The Miwok, a tribe whose territory extended from the crest of the Sierra Nevada to the San Joaquin River, and from the Cosumnes to the Fresno in a part of the San Joaquin Valley where the jack rabbit is now extremely abundant, used rabbit skins for making robes. They cut the skins into narrow strips, and after drying them in the sun, laid them close together and made a rude warp, by tying or sewing strings across at intervals of a few inches.[1]

In order to show some of the uses to which jack rabbit skins might be put, it will be necessary to refer briefly to the general trade in rabbit skins and some of the ways in which the lower grades are utilized. The annual collection of English rabbit skins is about 30,000,000, and 50,000 to 80,000 dozen (600,000 to 960,000) are imported from France and Belgium. These skins are dyed and sold for fur to be used for caps, boas, muffs, and trimmings of various kinds, and are used for felting, especially in the manufacture of hats. Skins for felting are cut open, washed, and the long hairs pulled out with wooden knives; the fur is then cut off by machinery, sorted, and blown by air. The fur from different parts of the body is separated and sold at different prices. The best Coney back wool used in the manufacture of felt hats brings from 5s. to 7s. 6d. per pound.[2]

In the United States skins of native rabbits are used for fur, if at all, only for trimmings, as the hair is too brittle and they have very little underfur. Large numbers, however, are used for felt in the manufacture of hats. It is estimated by one of the leading furriers in New York that 1,500,000 native skins are collected annually in this country. In addition to these, rabbit skins are imported, not only from Great Britain and the continent of Europe, but even from Australia. Native skins are mainly those of the cottontail (*Lepus sylvaticus*), and the supply is derived largely from Maryland, Virginia, and North Carolina. They are assorted into three grades, 'primes,' 'seconds,' and 'culls.' Prime skins are those of full-grown animals with bright pelts; 'seconds,' of half grown animals; while the torn or imperfect pelts are classed as 'culls.' The prices range from 1¼ up to 4 cents apiece, averaging during 1895 about 1¾ to 2 or 2½ cents for the best skins. Imported skins are considered superior to those of "cottontails," averaging in value about 3½ cents each, although the best French rabbit skins are worth 5 cents. One of the New York dealers reports that skins of the native hare, probably the Varying Hare (*Lepus americanus*), are worth 6 cents each, but that very few are received in a season. England, however, in 1891 received 36,286 skins of the American Varying Hare from the Hudson Bay Company, and 50,000 from other traders. It may be stated here that the Hudson Bay Company has been shipping rabbit skins to England for more than one hundred years. Most of these are skins of *Lepus americanus*, and according to Poland[3] the total number exported between 1788 and 1890 was 3,333,933, or an average of 39,750 for the eighty-four years for which statistics are available.

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[1] Powers, Tribes of California, Cont. N. Am. Ethnology, Vol. III, 1877, p. 351.

[2] Poland, Fur-bearing Animals, London, 1892, p. 281 et seq.

[3] *Loc. cit.*, pp. xxiii–xxvii, 276–277.

Rabbit skins have formed a large item of export from Australasia, chiefly from the colonies of New Zealand, Tasmania, and Victoria, for nearly twenty years. In Victoria the number exported increased nearly fifteenfold from 1876 to 1893, when it reached 10,374,154. Shipments from New Zealand were trebled between 1879 and 1893, reaching in the latter year over 17,000,000, valued at about £140,000 or nearly $700,000. The following table shows the number of skins exported from Australasia so far as figures are available:

Export of Rabbit Skins from Australia, New Zealand, and Tasmania.[*]

Year.	New Zealand.		Tasmania.		Victoria.		S. Australia.	
	Number of skins.	Value.	Number of skins.	Value.	Number of skins.	Value.	Packages skins.	Value.
1873	[†]36,716	£1,263	....	....	....	....	....	....
1874	56,504	1,878	....	....	....	....	....	....
1875	111,142	3,913	....	....	....	....	....	....
1876	311,632	4,418	....	....	724,985	£6,711	....	....
1877	918,236	8,630	....	....	700,565	5,790	....	....
1878	636,409	33,460	....	....	711,844	6,206	....	....
1879	5,384,506	46,799	....	....	1,036,372	7,322	....	....
1880	7,505,616	66,976	....	....	3,309,408	21,674	....	....
1881	8,514,685	84,774	....	....	4,473,108	32,217	....	....
1882	9,198,837	88,725	1,881,040	£15,699	4,929,432	37,538	....	....
1883	9,891,805	100,955	1,735,856	20,367	4,245,596	30,364	....	....
1884	9,807,665	107,514	1,730,628	14,537	4,963,371	37,243	....	....
1885	9,168,114	85,754	2,872,896	22,572	3,424,259	23,548	86	£883
1886	8,546,254	65,694	1,184,862	7,400	910,609	6,800	35	602
1887	12,743,452	111,172	2,181,068	17,555	2,663,314	16,294	398	7,534
1888	11,809,407	91,908	1,961,576	12,661	3,967,538	20,759	725	9,578
1889	11,342,778	96,039	1,819,547	11,369	3,429,015	12,303	208	3,081
1890	12,543,293	111,880	2,991,316	24,362	4,913,351	25,667	594	11,320
1891	14,302,233	126,251	3,241,351	19,571	6,359,210	31,367	618	9,239
1892	15,899,787	121,775	3,180,104	17,097	7,501,864	31,905	496	8,790
1893	17,041,106	138,952	3,590,474	23,278	10,374,154	55,039	419	6,958
1894	14,267,385	87,993	3,541,464	16,194	....	....	980	10,973
Total[‡]	180,037,562	1,586,723	31,912,182	222,562	68,637,990	408,747	4,554	68,958

The importation of Australian rabbit skins in London, as shown by reports of sales, aggregated 8,210 bales in 1890–91, and from July, 1894, to July, 1895, amounted to 13,140 bales, each averaging about 400 pounds and containing about 4,000 skins. The total number in 1894–95 was, therefore, about 52,500,000 skins, valued (at $70 per bale) at nearly $1,000,000.

It should be noticed that no less than one-third of the Australian skins sent to London are said to be exported to New York. There are now 20 cutters of hatter's fur in America, employing about 160 machines. Each machine will cut on an average 1,200 skins a day, producing 75 pounds of cut fur. If all the machines were kept running for two hundred and fifty days per annum they would require 48,000,000 rabbit and hare skins. The output of fur would be about 3,000,000 pounds, which, valued at 85 cents per pound, would give a total of $2,550,000; deducting $600,000 for cost of cutting, estimated at 20 cents per pound of fur, the value would be $1,950,000.[1]

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[*] Compiled from Statistics Colony New Zealand, 1881–1890; New Zealand Year Books, 1891–1895; Statistics Colony Tasmania, 1882–1894; Victorian Year Book, 1893, II, p. 262, 1894, I, p. 437; Statistical Register South Australia, 1885–1894.

[†] The returns from New Zealand for 1873–1880 are taken from U. S. Consular Repts., VI, 1882, p. 122. The values are only approximate being reduced from dollars at the rate of £1 = $5—the rate apparently used in obtaining the value for 1881 in the Consular Report. Returns for 1891–1894 are taken from the Year Books under reports of export of wool.

[‡] The total exports from Australasia can not be obtained from these figures as some of the skins from New Zealand and Tasmania were shipped to other colonies, particularly Victoria, and such skins may have been reexported, e. g., the direct exports from Tasmania to Europe from 1886 to 1892 formed a very small percentage of the total exports, the bulk of the skins being shipped to Victoria.

Jack rabbit skins apparently have not been utilized to any great extent, but if they can not compete with the best native or foreign skins in quality, they certainly can be used for many purposes for which skins of inferior grades are employed. In addition to being utilized for fur and felt, rabbit skins are used for making gelatine, jujube, sizing, and glue, and in Spain it is said that the hair is sometimes used in place of down. For these purposes skins of jack rabbits ought to be as good as any. If skins can be shipped from Australia to the United States by way of London and then sold at a profit for 3 cents apiece, there ought to be a large market for native skins. Jack rabbit skins can be collected with such facility in the West that they could probably be sold at a lower price than those of the cottontail or any imported skins of the same grade and still allow a margin of profit.

JACK RABBITS AS GAME.

Between the months of October and March, jack rabbits are sold in considerable quantities in the larger cities of the United States from San Francisco to Boston, and from St. Paul to New Orleans. Both the Prairie Hare and the Blacktailed Jack Rabbit are shipped to Eastern markets, but in California the Texan Hare and the California Jack Rabbit are the only ones commonly sold. The business of handling this game is larger than is generally supposed, and while by no means equal to the trade in cottontails, is capable of being developed into an important industry to the mutual benefit of the consumer and of the farmer who suffers from the depredations of the rabbits.

PARASITES.

Many persons have a prejudice against eating jack rabbits because the animals are infested at certain seasons with parasites, or because the flesh is supposed to be 'strong.' This prejudice, however, is entirely unfounded. The parasites of the rabbit are not injurious to man; furthermore, the ticks and warbles occur at a season when the rabbits should not be killed for game, while the tapeworm can only develop in certain of the lower animals, e. g., in the dog or the coyote. The most important parasites of the jack rabbit are ticks (*Ixodes*) and larvæ of a fly (*Cuterebra*) and of a tapeworm (*Tænia*). Ticks are especially troublesome during the summer and may sometimes be found clustered about the ears in great numbers. A large fly of the genus *Cuterebra* attacks these hares as it does deer, squirrels, and wood rats, and punctures the skin in order to find a suitable place to lay its eggs. The egg hatches soon after being deposited, and the parasitic larva, becoming incased in a capsule immediately beneath the skin of its host, forms a lump sometimes an inch or more in length, which is usually known as a 'warble.' These warbles are most often seen in July or August. The larva emerges from its case in due time as a perfect insect, and the wound heals, leaving little or no scar. On some of the rabbits brought to market large 'water blisters' or 'boils' are occasionally found, which are the larvæ of a tapeworm (*Tænia serialis*). This larva is called *Cœnurus serialis*,[1] and has been found in the California Jack Rabbit (*Lepus californicus*), the Prairie Hare (*L. campestris*), the Old World Hare (*L. timidus*) and rabbit (*L. cuniculus*), the coypu of South America (*Myopotamus coypu*), a species of squirrel (*Sciurus*), and in the horse.[2] *Cœnurus* does not develop into the adult tapeworm in any of these animals; but in the dog, and in the coyote, which eats many rabbits, it reaches the adult stage.

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[1] These figures have been kindly furnished by Messrs. J. P. McGovern & Bro., importers and fur brokers, of New York.

It is sometimes said that trichinosis may result from eating jack rabbits, and such reports are occasionally circulated by the press. The State board of health of Iowa recently published a report on trichinosis, in which it referred to the source of the disease in the following terms, implying that there was danger of infection from rabbits: "In all cases known the hog has been the source of the disease in human beings, so it may be said of nearly, if not all cases, that they are caused by eating trichinosed pork, although the rabbit and the hare are considered not behind the hog in susceptibility to trichinosis. Hogs become infected mostly from rats, and rabbits and hares become mouse hunters in winter." (Seventh Biennial Report, 1893, p. 80.)

Hares and rabbits rarely if ever eat mice or other small mammals, and the danger of infection from this source is of no practical importance. It may be confidently stated that there is no authentic case of trichinosis in rabbits on record, except in those which have been purposely infected. Until it can be shown that trichinæ are actually found in our native species, no danger need be apprehended in using rabbits as game.

HOW THE GAME IS KILLED AND SHIPPED.

It would be interesting to know the extent to which jack rabbits are sold in the United States, but unfortunately it is practically impossible to obtain complete statistics. All that is possible is to cite a few cases which will give some idea of the business. A correspondent in Goshen, Cal., states that he sent at one time (February 16, 1889), after one of the large drives, as many as 400 jack rabbits to the San Francisco market. In the fall of 1892 one of his neighbors made a business of market hunting, sometimes killing six dozen jack rabbits per day, and in one week he secured 26 dozen. This man shot from a one-horse buckboard, and nearly all the game was retrieved and brought to the wagon by his setter. During the autumn of 1894 three men and a boy killed about 200 rabbits per day and sent them to San Francisco. The shipments from Goshen during the month of November 1894, amounted to about 1,000 jack rabbits, weighing 3,860 pounds.

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[1] For a popular account of these 'blisters' see an article entitled "Cœnurus of the Hare," by Katherine Brandegee, in Zoe. Vol. I, Nov., 1890, pp. 265–268.

[2] This list of hosts of *Tænia serialis* has been kindly furnished by Dr. C. Wardell Stiles, Zoologist of the Bureau of Animal Industry, U. S. Dept. of Agriculture.

Two hunters in Kern County, Cal., made a series of thirteen rabbit drives last winter for the purpose of obtaining rabbits for market. These drives were made in various localities near Delano, beginning on November 14, 1894. More than 25,000 jack rabbits were secured and about two-thirds of them were shipped, bringing from 50 cents to $1.25 per dozen in San Francisco. The venture, however, proved unsuccessful, as the expenses for sacks, twine, commission, and transportation amounted to 61 cents per dozen and many of the rabbits spoiled in transit. It was claimed that if the bounty had not been removed there would have been a profit instead of a loss.

Many jack rabbits are shipped to market from Kansas. Norton, Winona, and other places in the western part of the State send the game to Denver, while from points in central and southern Kansas a good deal is shipped direct to New York and other Eastern cities. A commission merchant in Great Bend, Kans., states that he shipped about 4,200 jack rabbits (350 dozen) during the winter of 1893–94 and about 6,000 (500 dozen) during the winter of 1894–95. Most of this game was sent to Kansas City, Chicago, New York, Baltimore, and Boston. Considerable quantities are also shipped to the New York market from Independence, Kans. A single invoice of several hundred pair was received from that point in the winter of 1889–90, and a commission merchant writes that his shipments from Independence have been increasing gradually during the last few years at the rate of 200 to 300 per year. In the winter of 1894–95 he shipped about 1,600 jack rabbits direct to New York. McPherson County is one of the main shipping centers in the State, and a dealer in Marquette writes that he handled 2,646 jack rabbits last season. The freight traffic manager of the Atchison, Topeka and Santa Fe Railroad reports that three carloads were forwarded from McPherson in the winter of 1893–94, two consigned to Chicago and one to New York. Last season the McPherson Produce Company handled 7,927 jack rabbits, and the total shipments from that place average about five carloads, or 20,000 rabbits a season, 75 per cent being sent to New York. The game is not often forwarded in carload lots, but is usually shipped with dressed poultry in ordinary refrigerator cars.

The Black-eared Jack Rabbit (*Lepus melanotis*) is the principal species shipped from Kansas, but the white-tailed Prairie Hare (*L. campestris*) is sold in even greater numbers in Eastern cities, and the bulk of the supply probably comes from the Dakotas, Nebraska, Minnesota, and Iowa. In Newcastle, Wyo., a single hunter killed over 100 Prairie Hares for market during the season of 1893–94. One dealer in Pierpoint, Day County, S. Dak., reports that he has shipped from 1,200 to 1,500 per annum for the last three years, and a correspondent in Watertown, S. Dak., writes that probably 50,000 rabbits were killed in Codington County, S. Dak., last season, although not all were used for food. The severe winter following the drought of 1894 resulted in the destruction of larger numbers than usual, and no doubt many persons in Dakota and Nebraska gladly availed themselves of this source of supply.

As already stated, part of the game in California is secured by means of rabbit drives. In eastern Colorado large quantities are killed during the annual hunts at Lamar and Las Animas, but as the rabbits are killed for sport, and not especially for market, many of them are donated to the poor of Denver and Pueblo. In Kansas large numbers of jack rabbits are killed after heavy snowfalls, and in Chautauqua and Montgomery counties it is said that the farmers sometimes bring them in by the wagon load; the hunters usually receive about 10 cents apiece for them. Near McPherson one method of hunting is to stretch a wire between two wagons about 200 yards apart, and allow it to drag in the grass or stubble as they proceed. As the rabbits are started they are shot from the wagons or by two hunters who follow behind. In this vicinity the prices vary from 15 cents apiece in October, down to 5 cents in January.

Jack rabbits are shipped to market either by express or freight. At Goshen, Cal., they are cleaned and hung up over night to cool off, and are then simply placed in barley sacks (each holding from 25 to 30), and sent by express. Kansas shippers usually forward the game by ordinary freight during cold weather, but at other times in refrigerator cars. Some pack the rabbits without ice in boxes holding from 2½ to 3 dozen each; others wrap the game in paper or excelsior and pack it in barrels containing 4 or 5 dozen rabbits. Another method is simply to cord them up in refrigerator cars, thus saving the cost of packages and packing.

THE MARKET.

Jack rabbits usually bring from 75 cents to $3 per dozen, depending on the demand and the expense of shipping. In some cases they are sold at a much higher figure. During the winter of 1890 some black-tailed jack rabbits were sold at retail in the New York market at $1.50 per pair,[1] and in December 1895, a few Prairie Hares were retailed in the Washington market at $1 apiece.

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[1] Mearns, Bull. Am. Mus. Nat. Hist., II, Feb., 1890, p. 298, footnote.

The following table shows the ordinary market prices in some of the larger cities for the season of 1894–95:

*Market Prices of Jack Rabbits, 1894–95.**

City.	Date.	Price per pair.	Price per dozen.	Average price per dozen during season.
San Francisco, Cal	Oct. 20, 1894		$0. 50–$1. 00	$0. 67–$1. 00
	Oct. 27–Nov. 24, 1894		. 75– 1. 00	
	Jan. 12, 1895		. 75– 1. 00	
	Feb. 9, 1895		1. 00	
Denver, Colo				1. 25– 2. 50
Chicago, Ill	Dec. 1, 1894		2. 00– 3. 50	1. 75– 2. 66
	Dec. 15, 1894		1. 50– 2. 00	
	Feb. 23–Mar. 2, 1895		1. 75– 2. 50	
New Orleans, La				1. 50– 2. 50 2. 00– 2. 75
St. Paul, Minn				1. 75– 3. 00
St. Louis, Mo				2. 25
Boston, Mass	Jan. 26–Feb. 2, 1895	$0. 25–$0. 50		1. 50– 3. 00
New York, N. Y	Dec. 22, 1894	. 40– . 60		2. 40– 3. 45
	Dec. 29, 1894	. 40– . 55		
Washington, D. C	Jan. 26–Feb. 2, 1895		3. 00	3. 00

*Returns for Boston, New York, and Chicago are taken from the market review in the American Agriculturist, Vols. LIV and LV; for San Francisco, from the Pacific Rural Press, Vols. XLVIII and XLIX; figures for St. Louis have been kindly furnished by the St. Louis Poultry and Game Company; for St. Paul, by R. E. Cobb; for New Orleans, by Messrs. H. & S. Blum, and for Denver, by H. O. Munger & Co.

As might naturally be supposed, some of the largest markets for jack rabbits are in the cities of California where the game is sold at a lower price than elsewhere. San Francisco probably uses more than any other single city in the United States, and it is said that this game is received during the winter months at the rate of 100 to 150 dozen per day. An estimate obtained by the board of trade from the commission merchants places the total number consumed per annum at about 96,000. The game is supplied principally by the counties of Fresno, Merced, and Tulare, in the San Joaquin Valley. Los Angeles is supplied by the southern counties of Los Angeles, Orange, Riverside, San Bernardino, and San Diego. The number sold as estimated by the Chamber of Commerce, averages from 12 to 15 dozen per week the year round, or approximately 7,500 to 9,200 per annum, most of which is received during the winter months.

An estimate furnished by the Chamber of Commerce places the number of jack rabbits sold in Salt Lake City, Utah, during the winter of 1894–95 at 10,000 to 15,000. Many more were given away, and the secretary, Mr. E. F. Colburn, explains that perhaps more were consumed than usual, owing to the fact that the rabbits were slaughtered in large numbers in regular hunts and were donated to the poor. In Denver, Colo., large numbers of jack rabbits are donated to the poor, but many are also sold as game. One commission house reports that for the last ten years they have handled from 13,000 to 15,000 each season, although large quantities are rarely found in market at any one time. The game comes from the eastern part of the State and from western Nebraska and Kansas. Omaha, Nebr., is supplied by the western part of the

State and by Wyoming, largely from the region between the Fremont, Elkhorn and Missouri Valley and the Burlington and Missouri River railroads. No reliable statistics of the number consumed in Kansas City, Mo., are at hand, the estimates ranging from a few hundred dozen up to about 75,000.

Texas probably furnishes most of the rabbits sold in the markets of its principal towns as well as some of those in New Orleans. Only a limited number of 'jacks' are used in New Orleans—probably not more than 25 per cent of the total number of rabbits sold—and these are shipped mainly from points along the Kansas City, Fort Scott and Memphis Railroad.

Minneapolis and St. Paul, Minn., receive their main shipments from North and South Dakota and Minnesota. It is reported that 12,000 jack rabbits (1,000 dozen) were handled by a single commission house in St. Paul during last winter, probably nine-tenths of which were obtained from the Dakotas, the remainder being received from Minnesota and Iowa.

Estimates of the number of jack rabbits sold in the markets of some of the cities west of the Mississippi River have been obtained from boards of trade, chambers of commerce, or reliable commission merchants, and are shown in the following table. Such figures are only approximate, but in most cases are based on the sales of the season of 1894–95:

Estimates of Jack Rabbits sold in Western Cities.

City.	Number of rabbits.	Authority.
Los Angeles, Cal	7,500-9,200	Chamber of Commerce.
San Francisco, Cal	96,000	Board of Trade.
Denver, Colo	30,000	H. O. Munger & Co.
Pueblo, Colo	1,000	Jno. M. Killin & Co.
New Orleans, La	2,500	Bennett & Co.
Minneapolis, Minn	25,000	Produce Exchange.
St. Paul, Minn	*12,000	R. E. Cobb.
Kansas City, Mo	†25,000	
St. Louis, Mo	35,000	St. Louis Poultry and Game Co.
Omaha, Nebr	60,000	Peycke Bros.
Salt Lake City, Utah	10,000–15,000	J. P. White.

* Handled by a single commission house. † Approximate.

Most of the jack rabbits sold in Chicago, St. Louis, New York, Boston, Philadelphia, Baltimore, and Washington seem to come from the Great Plains—from Kansas to North Dakota—but the attempt to secure accurate statistics from Eastern cities is almost hopeless, as quantities of the large Varying Hares (*Lepus americanus*) are also received and sold indiscriminately with jack rabbits under the name of hares.

These data will give some idea of the extent to which jack rabbits are shipped to market. The total number sold in the cities mentioned above is about 300,000. Allowing an equal number for local consumption in small towns and for those sold in other cities would give 600,000 as a very rough approximation of the total number consumed in the United States per annum. Estimated at the rate of $1.50 to $2 per dozen the total value would be about $75,000 or $100,000. This, however, is only a small proportion of the total number of rabbits used as game, since cottontails are sold everywhere in much larger quantities.

In connection with these figures it will be interesting to compare the number of rabbits sold in one of the large cities of Australia. Melbourne, the capital of Victoria, according to the census of 1891, had a population of 490, 896—somewhat more than that of San Francisco, Cal. The following table from the Victorian Year Book for 1893 (Vol. II, p. 262) shows the number of rabbits sold in Melbourne during the seven years from 1886 to 1893:

Number of Rabbits shipped to markets of Melbourne, Australia.

Year.	Number of couples of rabbits—		
	Sold.	Condemned.	Total.
1886-87	346, 856	4, 460	351, 316
1887-88	418, 618	2, 272	420, 890
1888-89	474, 384	13, 458	487, 842
1889-90	606, 568	11, 567	618, 135
1890-91	676, 796	5, 955	682, 751
1891-92	572, 426	17, 977	590, 403
1892-93	617, 773	19, 275	637, 048
Total couples	3, 713, 421	74, 964	3, 788, 385
Total rabbits	7, 426, 842	149, 928	7, 576, 770
Average per annum	1, 060, 977	21, 418	1, 082, 395

Evidently rabbits are more extensively used for food in Australia than in this country, but in comparing the figures it should be remembered that the statistics for Melbourne include the total number of rabbits sold, whereas those given for jack rabbits consumed in the cities of the United States represent only a part of the rabbits sold.

England imports, it is said, about 124,000 hundredweight of rabbits yearly for food, which are valued at £342,000.[1]

So far as known, little or nothing has been done in the United States in the way of canning jack rabbits, although the subject has been discussed occasionally. When rabbit driving was being agitated in Tulare County, Cal., the Visalia Delta of January 26, 1888, published an article on "Money in Rabbits," which advocated canning some of the jack rabbits which were being killed in large numbers at that time. The article was based mainly on statistics of the industry in New Zealand, and apparently the suggestion has never been adopted, at least not on a commercial scale. After making special inquiries concerning the utilization of rabbits, Mr. C. D. Willard, secretary of the Los Angeles Chamber of Commerce, reports: "No use whatever is made of the skins here, and as far as I can learn no one has ever heard of canning the meat." Mr. D. R. Payne, of Independence, Cal., writes under date of September 18, 1895: "Many years ago there was a cannery engaged in putting up all kinds of wild game, and probably they used some jack rabbits, but during my long residence in California I never saw them in the market put up in cans."

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[1] Simmonds, Commercial Dictionary of Trade Products, London, 1892, p. 486.

There seems no good reason why rabbits can not be profitably canned, and some commission merchants claim that this would relieve the glut in the market at certain times in winter and bring about better prices. Several preserving companies are in operation in Victoria and in New Zealand. In October, 1886, Hon. James M. Morgan, then United States consul-general at Melbourne, Australia, reported that "in the Colac and Camperdown district [Victoria] a preserving factory was started some few years back and operations carried on with vigor, the factory working each year for about six months, from March to October, and during that period purchasing from 750,000 to 1,000,000 rabbits, the price paid being about 2s. 6d. per dozen. These rabbits are nearly all obtained from the stony rises and surrounding districts, as they can not be sent to the factory in proper condition from any great distance." (U. S. Consular Repts. for Dec., 1886, XX, pp. 482–484.)

GENERAL SUMMARY AND CONCLUSIONS.

(1) The various species of jack rabbits are all more or less alike in habits, and all feed largely on bark and herbage.

(2) When food is easily obtained, and particularly on newly cultivated land, the rabbits increase rapidly and do great damage to crops. The black-tailed species are more gregarious than the Prairie Hare, and as a rule are more destructive.

(3) The best means of protecting crops from the attacks of rabbits, and in fact the only method which can be relied on, is the use of rabbit-proof fences.

(4) Under favorable circumstances great numbers of jack rabbits may be killed by drives or large hunts, but this means will only serve to reduce their numbers, and can not be used to exterminate the pests.

(5) Bounties or other direct expenditures of public money for the destruction of rabbits have failed to accomplish the desired object. Bounty laws afford unusual opportunities for fraud, and the amounts expended are often so large as to be a serious burden on the county or State.

(6) The extermination of rabbits can only be accomplished by cooperation on the part of individual farmers or landowners. The work of destruction can be most effectually and economically done when the animals have suffered an unusual decrease in numbers, either from a severe winter, lack of food, or an epidemic.

(7) Commercial utilization is the most promising and least expensive method of keeping these pests in check in localities where they are

unusually abundant; but returns from this source will only partially offset the losses sustained on account of injuries to crops.

(8) Jack rabbits may be used for coursing, for their skins, or for food. The United States imports annually millions of rabbit skins for felt and other purposes. The skins of jack rabbits could probably be used for many purposes for which the cheaper grades of imported skins are now utilized, and could be collected so cheaply as to leave a margin of profit.

(9) The consumption of jack rabbits for food amounts to about 600,000 per annum, and is gradually increasing. This game can be obtained in considerable quantities on the plains and on the deserts of the Great Basin, and may be profitably shipped to Eastern markets to the mutual benefit of the farmer and the consumer.

(10) In America the rabbit question never has, and probably never will, assume the proportions it has assumed in Australia. The jack rabbits of the United States are all indigenous species and ordinarily are held in check by natural enemies and by disease. Although local conditions may sometimes favor their temporary increase, yet natural agencies, aided by the persistent and constantly increasing war of extermination, are gradually, but none the less surely, diminishing their numbers.

ARTICLES ON RABBITS.

The following list contains references to only a few of the more important articles on jack rabbits and the rabbit pest in Australia. Some of these papers have been referred to in scattered footnotes, but are here grouped under several headings for convenience of reference. Very little has been published on rabbit driving, and this mainly in the form of brief notes and descriptions of single drives which are mentioned below.

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Griffin, G. W., The Rabbit Skin Trade of New Zealand, U. S. Consular Repts., XIX, May, 1882, pp. 118-122.

Poland, Henry, Fur-Bearing Animals, 1892.

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American Field, XXX, 1888, p. 504; XXXIII, 1890, pp. 395–396, and subsequent volumes.

H[older], C. F., Mounted Sport in California, Forest and Stream, XXVIII, 1887, pp. 2–3.

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Allen, J. A., Proc. Boston Soc. Nat. Hist., 1875, pp. 430-436. Monographs N. Am. Rodentia, 1877.

Audubon and Bachman, Quadrupeds of N. Am., Vols. I–III, 1851.

Bachman, John, Jour. Acad. Nat. Sci., Phila., VII, pt. II, 1837, p. 282 et seq; VIII, 1839, p. 75 et seq.

Baird, S. F., Mammals N. Am., 1857.

Gray, J. E., Charlesw. Mag. Nat. Hist., I, 1837, 586–587 (*Lepus californicus*). Ann. and Mag. Nat. Hist., 3d ser., XX, 1867, pp. 221–225.

Lewis and Clark Exped., Coues' edition, Vol. III, 1893, pp. 865–866 (Prairie Hare).

Mearns, E. A., Bull. Am. Mus. Nat. Hist., New York, II, Feb., 1890, pp. 294–304 (*Lepus alleni* and *L. melanotis*).

Waterhouse, G. R., Nat. Hist. Mamm., II, Rodentia, 1848.

DISEASES, INOCULATION, AND PARASITES.

Brandegee, Katherine, Cœnurus of the Hare, Zoe, I, Nov., 1890, p. 265–268.

Progress Rept. Roy. Comm. Inquiry Exterm. Rabbits in Australasia, 1890, pp. 138–215.

Rept. to the Legislative Assembly of New South Wales on the Rabbit Pest, 1888, pp. 1–17.

Thomas, A. P. W., Report on Rabbit Nuisance in Wairarapa District, New Zealand, 1888, pp. 1-7; 1889, pp. 1-14.

DRIVES AND HUNTS.

[Editorial] Driving the Jack Rabbits, San Francisco Mining and Scientific Press, Jan. 28, 1888, p. 51 (Bakersfield, Cal.).

Fremont, J. C., Expl. Exped. to Oregon and California, 1845, p. 227.

Greene, C. S., Rabbit Driving in the San Joaquin Valley, Overland Monthly, XX, July, 1892, pp. 49–58 (Traver, Cal.).

Manly, W. L., Death Valley in '49, p. 110 (near Little Salt Lake, Utah).

Sayers, R. H., A Jack Rabbit Hunt, Am. Field, XLI, No. 10, Mar. 10, 1894, p. 222 (Lamar, Colo.).

Scientific American, LXI, Nov. 19, 1889, p. 295 (Wildflower, Cal.).

Shooting and Fishing, XV, 1894, pp. 221, 303; XIX, Jan. 2, 1896, p. 225 (Lamar, Colo.).

Townsend, C. H., A Jack Rabbit Drive, Forest and Stream, XXXVIII, Mar. 3, 1892, p. 197 (near Fresno, Cal.).

Townsend, J. K., Narrative of a Journey Across the Rocky Mountains, 1839, p. 327.

White, N. E., A California Rabbit Round-up, Am. Field, XXX, Nov. 3, 1888, p. 410 (Bakersfield, Cal.)

HABITS.

Coues, E., American Rabbits or Hares, Am. Sportsman, Aug. 29, 1874.

Coues, E., Habits of the Prairie Hare, Bull. Essex Institute, VII (1875), 1876, pp. 73–85.

Coues, E., Am. Naturalist, I, Dec., 1867, pp. 531–534 (*Lepus texianus*).

Van Dyke, T. S., Southern California, 1886, pp. 130–132.

RABBITS IN AUSTRALIA.

Final Rept. Roy. Comm. Inquiry Exterm. Rabbits Australasia, 1890, pp. 1–20.

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Frank Baker

BULLETIN No. 9

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

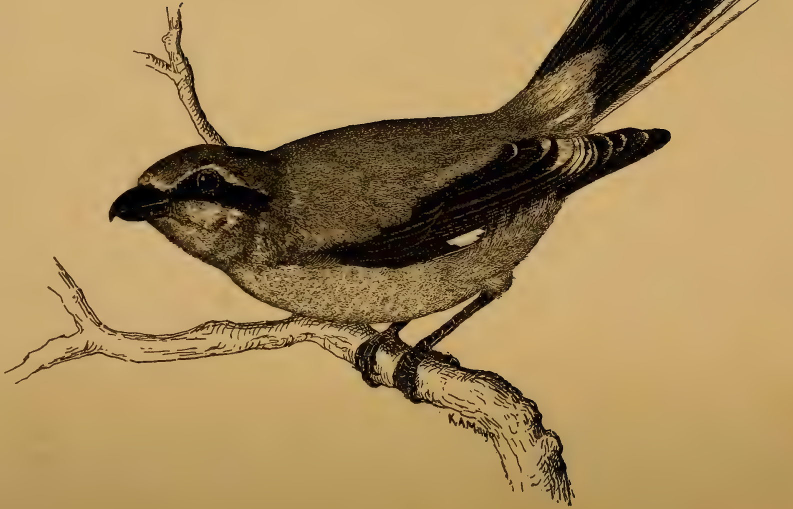
CUCKOOS AND SHRIKES

IN THEIR RELATION TO AGRICULTURE

THE FOOD OF CUCKOOS - -	**By F. E. L. Beal, B. S.**
THE FOOD OF SHRIKES - -	**By Sylvester D. Judd, Ph. D.**

Prepared under the direction of
DR. C. HART MERRIAM
CHIEF OF BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1898



BUTCHERBIRD OR NORTHERN SHRIKE (*Lanius borealis*)

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., June 15, 1898.

Sir: I have the honor to transmit herewith, and recommend for publication as Bulletin 9 of this Division, two papers on the food habits of birds, based on investigations conducted in the laboratory of the Biological Survey by Prof. F. E. L. Beal and Mr. Sylvester D. Judd.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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CUCKOOS AND SHRIKES IN THEIR RELATION TO AGRICULTURE.

THE FOOD OF CUCKOOS.

By F. E. L. BEAL, B. S.

GENERAL NOTES.

Cuckoos are quiet and rather shy birds. While they do not avoid the haunts of man, they nevertheless have a way of concealing themselves in foliage, seldom alighting on naked branches or in exposed places, and hence are not often seen. Their favorite resorts are open groves or woods, the edges of forests, orchards, and clumps of trees or shrubs. They often visit shade trees about houses, and are frequently heard in the trees along village streets or even in city parks. In many parts of the country they are known as 'Rain Crows' or 'Kow-kows,' the syllables *kow-kow* being an imitation of their notes.

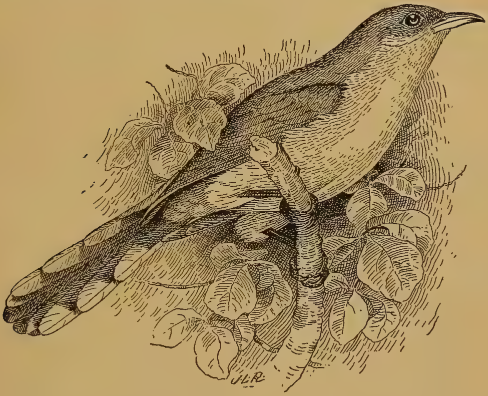

FIG. 1.—Yellow-billed cuckoo.

The cuckoo's nest is usually built in bushes or small trees at no great height from the ground, and is a flimsy affair, composed of a few sticks, forming a mere platform for the eggs, which vary in number from two to four. The European cuckoo, like our cowbird, lays its eggs in the nests of other birds; a reprehensible habit not shared by its American cousin, although occasional instances of such parasitism have been observed. Our cuckoos do not ostensibly rear more than one brood in a season, but they frequently lay their eggs at intervals, so that the young hatch successively, the later eggs being incubated in part by the young.

Three species and two subspecies occur in the United States. Of these, one species and one subspecies are restricted almost entirely to the southern coast of Florida, and are properly West Indian birds. The others occupy practically the whole country, except the plains and deserts, though in winter they are found in the extreme southern part only. The yellow-billed cuckoo (*Coccyzus americanus*) breeds from the Gulf of Mexico to southern Canada; the black-billed (*Coccyzus erythrophthalmus*) ranges still farther north. The northward migration does not begin until spring is well advanced, and is usually completed by the end of May. Most of the birds leave the Northern States in August, but some linger through September and even into October.

From an economic standpoint cuckoos rank among our most useful birds. Their habit of remaining concealed in foliage suggests, and close observation proves, that their diet consists for the most part of insects—very largely caterpillars—found on trees and shrubs.

EXAMINATION OF STOMACHS.

In the laboratory of the Biological Survey 109 stomachs of the yellow-billed and 46 of the black-billed cuckoo were examined. All were taken between May and October, inclusive, except one of the yellow-billed collected in Texas in January. These stomachs were obtained in twenty States, the District of Columbia, and Canada, and were fairly distributed over the country from Louisiana and Texas to Canada, and from Massachusetts to Kansas and Nebraska. A greater number would have been desirable, but the contents of those examined were so uniform that it seems fair to infer that they give a reasonably accurate idea of the general food of the species. It has been deemed best to treat the two species together, since they prove to be very much alike in diet. The greatest difference is that the yellow-billed cuckoo eats more beetles (Coleoptera) and fewer bugs (Hemiptera). The seasonal variation in diet is much less than in most birds. Of the 155 stomachs of both species examined, only one contained any vegetable food, and this only two berries of the wild rough-leaved cornel (*Cornus asperifolia*). One other stomach contained a bit of rubbish, probably taken accidentally with some insect. Drs. C. Hart Merriam and A. K. Fisher have seen the yellow-billed species feeding on mulberries in Westchester County, N. Y.,[1] and Dr. B. H. Warren found 'berries' in one of the nine stomachs examined by him.[1] These observations show that cuckoos do at times eat fruit, but the results of our investigation indicate that it is not their usual habit.

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[1] Annual Report, U. S. Dept. Agriculture for 1890, p. 285, 1891.

The insect food of cuckoos consists of beetles, grasshoppers, cicadas, bugs, ants, wasps, flies, caterpillars, and spiders, of which grasshoppers and caterpillars constitute more than three-fourths. The great majority of the insects found in the stomachs were harmful kinds. Caterpillars, katydids, and tree crickets are exactly the prey that cuckoos might be expected to secure from their peculiar method of hunting in foliage, while the large numbers of grasshoppers eaten furnish additional proof of the fact so often illustrated that birds are particularly fond of grasshoppers, and that species not naturally ground feeders become so during the grasshopper season.

It is a matter of common observation that cuckoos feed largely on caterpillars, and stomach investigations not only confirm this but show that unlike most other birds they eat freely of hairy and bristly species. Nearly half of the cuckoo's food was found to be caterpillars. An attempt was made to obtain an approximate idea of the actual number in the stomachs by counting the heads and jaws, but in many cases this was nearly impossible, as many of the insects were very young and the jaws consequently minute. The result of this estimate, however, showed that no less than 2,771 caterpillars were contained in 129 stomachs, or an average of more than 21 in each. If the whole number of stomachs (155) is considered, the average is reduced to 18, and it is absolutely certain that this is much below the actual number.

During May and June, when tent caterpillars are defoliating the fruit trees, these insects constitute half of the cuckoo's food. When cuckoos visit the nests of the tent caterpillars they apparently eat as many of the occupants as possible. Most of the stomachs that contained the larvæ at all were filled with them, some having more than 100 individuals. Mr. Otto Lugger, formerly of the Department of Agriculture, examined one stomach which was so full that he concluded that the bird had devoured the whole colony, as there were several hundreds of these hairy caterpillars.

Perhaps the most curious insects found in the cuckoo stomachs were the larvæ of the Io moth. These caterpillars are thickly covered along the back and sides with spines growing from tubercles, which are not only very sharp but poisonous, and sting the hand quite severely when carelessly touched. Nevertheless, they were found in five stomachs, one of which contained seven, another three, and the others one each.

It is noticeable that the larvæ of moths, particularly hawk-moths (*Sphingidæ*), are eaten much oftener than those of butterflies. Whether this comes from preference and selection on the part of the bird or from the greater abundance and more conspicuous habits of the insects still remains to be determined. As to the kinds of caterpillars eaten, it may be said that the hairy and spiny species far outnumber the smooth, but this may be due either to the greater abundance of the hairy ones or to the bird's preference.

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[1] Birds of Pennsylvania, 2d ed., p. 161, 1890.

This diet of hairy caterpillars has a curious effect upon the birds' stomachs. A cuckoo's stomach, unlike that of seed-eating species, has only a thin muscular coat on the outside, and the usual smooth lining is almost entirely devoid of rugæ or folds so characteristic of the stomachs of many birds. This inner layer is almost always found pierced by at least a few caterpillar hairs; often by so many as to be completely furred and the membrane itself almost entirely concealed. Incidentally this hairy lining affords an excellent means of determining the motion of the food during digestion. If a stomach is divided in the plane of its two greater diameters the hairs on each half will be found brushed around a center like the nap on the top of a silk hat, indicating that the whole mass of food revolves in this plane. It may also be noticed that the skins of caterpillars taken from the stomachs of birds are always twisted like a cord or rope, and often require considerable untwisting before their characters can be determined.

In a review of the food of cuckoos the most striking point is the great number of caterpillars or lepidopterous larvæ which enter into the year's diet. These insects are crude feeders, eating immense quantities of vegetable tissue, and are usually so distended with it that the amount of real nutrition in any one of them must be small. In fact, stomachs of birds that have eaten largely of caterpillars always show a quantity of this finely cut vegetable matter derived from the insects' stomachs. As digestion in birds is rapid it would seem necessary to fill the stomach several times a day with such quickly digested and slightly nutritious food as this, while the number of caterpillars found in a stomach at any one time probably represents but a small portion of the actual daily consumption. From these considerations it appears that cuckoos must eat an enormous number of larvæ in the course of a season. If the contents of all the stomachs examined are regarded as so many daily meals of the same bird, then the result indicates that the bird has eaten 2,771 caterpillars in 155 consecutive days, at the rate of only one meal each day, and some days not eating any. Now, 155 days is about the length of time that cuckoos remain in their summer range; moreover, as indicated above, one cuckoo must eat several meals a day, so this number (2,771) probably falls far short of the actual number of caterpillars devoured by each cuckoo during the season.

In view of such considerations it seems hardly possible to overestimate the value of the cuckoo's work. All caterpillars are harmful, many of them are pests, and any of them are likely to become so. The common tent caterpillar formerly fed upon the wild cherry, but has now turned its attention principally to apple trees, sometimes completely defoliating them. What this caterpillar has done, many others may do. In the cuckoos we probably have one of nature's most efficient checks on the increase of these harmful species. It is said that hairy caterpillars are protected by their coats from the attacks of the ichneumon flies; if this be true, the work of the cuckoos in destroying the hairy species is complementary to that of the ichneumons, which help to destroy the smooth-coated caterpillars. Considering the number of grasshoppers, locusts, and other insects that cuckoos eat in addition to caterpillars, it is evident that from an economic point of view these birds are two of our most valuable species, and as they have not been convicted of doing any harm, they should be protected and encouraged in every possible way.

Besides insects proper, a number of spiders were found in the stomachs examined, most of them the long-legged kinds commonly known as 'daddy longlegs' or harvestmen (*Phalangidæ*). One stomach contained seven, the mass of tangled legs looking like a bunch of coarse hair. When we consider the disgusting odor of these spiders, their long legs, and the fact that their bodies have the texture of sandpaper, we are again forcibly reminded that tastes differ. But the most remarkable thing which the cuckoos had eaten was a small tree frog (*Hyla*) which had been swallowed whole!

In view of Audubon's accusation that the yellow-billed cuckoo sucks the eggs of other birds, it may be said that eggshells were found in several stomachs taken in July and August, but only in very small quantities—no more than found in the stomachs of nearly every species that has been examined. It is probable that these were merely empty shells eaten for the sake of the lime they contained. It may be added that one stomach disclosed a snail shell, which was probably taken for the same purpose. A number of stomachs contained each from one to three bits of gravel, but why the stones were swallowed was not apparent. Cuckoos do not eat hard seeds, and even if they did their stomachs are not muscular enough to act as a mill for grinding, as are those of gallinaceous and fringilline birds.

GENERAL INSECT FOOD OF CUCKOOS.

BEETLES.

The beetles found in the stomachs belong to several families, no one of which forms any important percentage of the total food. The stomach taken in Texas in January contained 17 percent of beetles belonging to five different families, all harmful. Beetles constitute 14 percent of the food in May, but later in the season decrease, and after July practically disappear. The useful *Carabidæ* are rarely eaten, which is easily explained by the fact that they live on the ground, while the cuckoos feed mainly in trees. One bird, however, had eaten a specimen of *Calosoma scrutator*, one of the largest and most predatory of these beetles, which, it may be added, is one of the most disgusting in odor. This was probably the most useful insect that the birds had eaten. *Scarabæidæ* were somewhat more numerous than other beetles. The most noticeable of these was the goldsmith beetle (*Cotalpa lanigera*), which was found in 3 instances—6 specimens in one stomach and 3 in each of the others. Two stomachs contained each 2 specimens of the Colorado potato beetle (*Doryphora 10-lineata*). *Elateridæ*, *Buprestidæ*, *Tenebrionidæ*, *Cerambycidæ*, *Lampyridæ*, and a few *Rhynchophora*, or snout beetles, were also found. Among the latter was 1 specimen of the rice weevil (*Calandra oryzæ*). Altogether beetles constitute a little more than 6 percent of the year's food.

BUGS (HEMIPTERA).

Hemiptera, or bugs, are represented by cicadas, pentatomids, and a few others. The great bulk is made up of cicadas, or dog-day harvest flies, which seem to be a favorite article of food, as no less than 5 were found in one stomach and 4 in another. Stink-bugs (*Pentatomidæ*) were found in quite a number of stomachs, but not in large quantities. A few assassin bugs (*Reduviidæ*) were also detected. No Hemiptera were contained in the stomachs collected in January, but in the May stomachs they amount to 12 percent, and do not vary much until after August, when they begin to disappear. They amount to about 6½ percent of the food of the year.

GRASSHOPPERS (ORTHOPTERA).

The Orthoptera eaten by the cuckoos consist of common grasshoppers, katydids, and tree crickets. The common grasshoppers are evidently favorites, as is the case with so many other birds. Several stomachs contained from 10 to 20 of these insects—a good meal for so small a bird. Katydids and their eggs were found in many stomachs, and often several individuals in a single stomach. The snowy tree cricket (*Œcanthus niveus*) is another insect that would seem naturally to fall in their way, and which their stomachs prove that they often eat. Orthoptera collectively were found in 86 of the 155 stomachs examined, and constitute about 30 percent of the year's food. Beginning with about 3 percent in May, they increase to over 43 percent in July, and do not fall much below this point during the remainder of the year.

CATERPILLARS.

Nearly half of the yearly food (48.5 percent) consists of caterpillars, which were found in 129, or 83 percent, of the 155 stomachs examined. The stomach taken in January contained 15 percent; in May the percentage rose to 60; in July and August it fell off a little to make room for grasshoppers, and in September reached the maximum of 75.

One of the most conspicuous and interesting of these larvæ is the common tent caterpillar (*Clisiocampa americana*), which was recognized in 17 stomachs, and was almost certainly contained in many more, though the remains were too fragmentary for positive identification. When it is considered that this species can be obtained only during May and June and that only 50 stomachs were collected in these months, it will be seen that more than one-third of all the birds that could get these insects had eaten them. Though the remains in many stomachs could not be identified with certainty, there is no reasonable doubt that these caterpillars constitute at least half of all the food during this period.

Another caterpillar which appears very frequently in the cuckoo's diet is the destructive fall web-worm (*Hyphantria cunea*). In one stomach 217 heads of this insect were counted, and the fragments of others indicated that 250 would be nearer the correct number. The larvæ of the white-marked tussock moth (*Orgyia leucostigma*) are also frequently eaten. One stomach contained remains of a number of army worms (*Leucania unipuncta*), but as these caterpillars feed upon grass, grain, and other plants that grow in the open, they do not naturally fall in the way of cuckoos. It is probable that army worms would be more extensively eaten if the fields infested with them were in the immediate vicinity of woods. Besides eating caterpillars of ordinary size, cuckoos often indulge in a meal of the larvæ of the larger moths and hawk moths. Of the latter, *Protoparce carolina* and *Deilephila lineata* were found in several stomachs. In fact, sphingid larvæ appear to be favorites, and make up a large proportion of the hairless caterpillars eaten. Giant silkworms were represented by one larva of *Telea polyphemus*, the Io moth (*Hyperchiria io*) by 13 larvæ, and royal moths by 1 of *Eacles imperialis*, each as large as a man's finger. Only 3 butterfly larvæ were identified, one the black spiny larva of *Vanessa antiopa*, another the well-known *Limenitis disippus*, the third the larva of a skipper, *Eudamus tityrus*. While cuckoos eat many larvæ of Lepidoptera, remains of the adult insects were found only once. In this case the stomach contained the heads of several small moths of the *Arctiidæ*, a family whose larvæ are hairy.

MISCELLANEOUS INSECTS.

A little more than 5 percent of the food is made up of miscellaneous insects, consisting of Diptera, Hymenoptera, and a few others. Tipulids, or crane flies, constitute the greater part of the Diptera; they are found in quite a number of stomachs, but do not amount to much in bulk. Among the Hymenoptera, the most interesting, as well as those most frequently found, are larvæ of sawflies (*Tenthredinidæ*). These so closely resemble caterpillars that entomologists call them 'false caterpillars'; and it seems probable that this resemblance explains why the cuckoo eats them. They do not, however, appear distasteful, for one bird had eaten over 60. Larvæ of our largest species of sawfly (*Cimbex* *americana*) were found in several stomachs. Ants, too, are frequently eaten; probably captured when crawling over leaves or branches—possibly when tending their dairies of plant lice. One stomach from western Pennsylvania, taken on June 2, contained, among other insects, 2 curious heads of ants, which were identified by Mr. Pergande, of the Division of Entomology, as belonging to the genus *Cryptocarus*. This genus is not known from the United States, but is abundant in Mexico and the West Indies. The bird was probably a late migrant. A few other Hymenoptera were found, among them a specimen of that curious long-bodied creature, *Pelecinus polyturator*. In the stomachs examined a few dragon flies were detected, but not enough to constitute a perceptible percentage. There were also some spiders, mainly *Phalangidæ*.

As a matter of interest to the entomologist, as well as the ornithologist, a list of insects identified in the cuckoos' stomachs is appended:

INSECTS IDENTIFIED IN THE STOMACHS OF CUCKOOS.

- *Coleoptera:*
  - Calosoma scrutator.
  - Lachnosterna sp.
  - Osmoderma sp.
  - Cotalpa lanigera.
  - Gnorimus maculosus.
  - Euphoria melancholica.
  - Dichelonycha sp.
  - Lucanus sp.
  - Sandalus petrophya.
  - Lina scripta.
  - Disonycha abbreviata.
  - Chrysomela scalaris.
  - Doryphora 10-lineata.
  - Romaleum atomarium.
  - Prionus sp.
  - Leptura sp.
  - Buprestis sp.
  - Chauliognathus sp.
  - Phytonomus nigrirostris.
  - Tyloderma æreum.
  - Pissodes sp.
  - Calandra oryzæ.
  - Cratoparis lunatus.
- *Hemiptera:*
  - Brochymena sp.
  - Euschistus sp.
  - Nezara hilaris.
  - Cicada pruinosa.
  - Cicada tibicen.
- *Orthoptera:*
  - Œdipoda sp.
  - Pezotettix sp.
  - Ceuthophilus sp.
  - Œcanthus niveus.
- *Lepidoptera:*
  - Anisota senatoria.
  - Anisota virginiensis.
  - Alypia octomaculata.
  - Acronycta americana.
  - Hyperchiria io.
  - Eacles imperialis.
  - Clisiocampa americana.
  - Cerura sp.
  - Datana ministra.
  - Datana contracta.
  - Dryocampa rubicunda.
  - Deilephila lineata.
  - Eudryas unio.
  - Edema albifrons.
  - Heterocampa manteo.
  - Hyphantria cunea.
  - Leucania unipuncta.
  - Nadata gibbosa.
  - Notodonta sp.
  - Orgyia leucostigma.
  - Psychomorpha epimenis.
  - Smerinthus sp.
  - Protoparce carolina.
  - Spilosoma virginica.
  - Telea polyphemus.
  - Eudamus tityrus.
  - Vanessa antiopa.
  - Limenitis disippus.
- *Hymenoptera:*
  - Pelecinus polyturator.
  - Lophyrus sp.
  - Cimbex americana.
  - Camponotus sp.
  - Cryptocarus sp.

THE FOOD OF SHRIKES.

By Sylvester D. Judd, Ph. D.

HABITS OF SHRIKES.

Two species of shrikes inhabit North America. One, the loggerhead shrike (*Lanius ludovicianus et subspec.*), is a permanent resident in the United States; the other, the butcherbird (*Lanius borealis*), visits us from the north in winter. Either might be mistaken for a mocking bird, but upon close inspection is seen to have the hooked beak of a hawk; instead of possessing talons, however, it has weak and slender feet, thus combining characters of a bird of prey with those of a song bird.

During cold weather the shrike in wait for prey takes his stand on some high perch that commands a wide view. In this position he watches, ready to pounce on the first bird that twitters in the briers, or mouse that rustles in the grass. When the quarry has been secured, it is carried to a sharp twig or thorn and spitted, and then the hunter, ever eager to satisfy his desire for the chase, goes off to the hedgerows to search for more game. In Germany it is said that a closely allied species daily kills and impales nine victims, from which belief came the common name '*Neuntödter*' or Ninekiller. It is well known that the shrike kills and hangs up in his shambles more than he can utilize. But this apparently wanton slaughter may often be the salvation of many a shrike whose hunt over snow-covered fields has yielded no return.

This habit of impaling its prey is well described by Mr. Benjamin Mortimer who, in writing from Orange, Fla., says:

> In March, 1889, two instances of the loggerhead shrike's killing smaller birds came under my notice. In both cases the victim was a grasshopper sparrow, although birds of this species were few and scattered at that time, while the savanna sparrow was very abundant. The sparrows were impaled by the neck upon orange thorns, and there were no wounds on any other part of the body. * * * This bird (the shrike) impales its prey not only when it wishes to preserve it, but also when it intends to devour it immediately, and the long slivers on fresh pine stumps are commonly selected for the purpose wherever they can be found. The bird flies to a stump with its victim, usually a beetle, and forces it upon a sliver, just behind the thorax, thus having a convenient place to stand and a convenient fork to hold the morsel while he breaks open the hard shell and eats the softer parts. The same stump is resorted to many times by the same bird, so that it is common to find quantities of the legs and wing cases of beetles about these curious dining tables.

The habit of killing small animals and hanging up their bodies has given the shrike the appropriate generic name *Lanius*, which means 'butcher.' The name 'Butcherbird' is more properly applied to the larger northern bird, while to the smaller and more southerly species the title 'Loggerhead' shrike is given.

Different diets affect in time the structure of an animal. Special parts are developed for procuring and digesting food. But the rôle that food habits play in the production of such variations has not yet been fully worked out. All structures are necessarily developed and maintained in direct relation to function. Shrikes have special structures suited to their peculiar feeding habits. So long as the northern shrike or butcherbird is restricted to an animal diet, because of the relative scarcity of insects at the North during most of the year, it must be more of a meat eater than its southern cousin, the loggerhead. The struggle for existence in the North is so keen that the butcherbird, during cold weather, must hold itself in readiness to fly at the first bird or mouse that is sighted.

The food habits of the shrikes, so far as determined from the examination of 155 stomachs, collected during every month of the year, from Saskatchewan to Florida and from the Atlantic to the Pacific, are very similar to those of the sparrow hawk; that is to say, the food consists of mice, small birds, and insects, the latter mainly grasshoppers. Both birds are much less insectivorous in cold than in warm weather—the oncoming of winter and consequent increasing scarcity of insects necessitating a change in food.

In discussing the insectivorous habits of the shrike, it is hardly necessary to state that the destruction of grasshoppers is a great service to the farmer. The shrike also devours a large number of beetles, and often eats caterpillars, wasps, and spiders. Since it takes practically no vegetable food, it can not injure crops, unless indirectly, by killing birds and insects that prey upon insect pests. The birds selected, however, are for the most part seed eaters and consequently less valuable than the insectivorous kinds; and if it be granted that the harm done by the destruction of one of these birds is counterbalanced by the killing of one mouse, then it follows that the harm done by the shrike in killing birds is completely offset. Furthermore, the attacks of the shrike are often directed against the English sparrow, now so obnoxious in many parts of the United States. Concerning the insect food, it may be safely stated that the percentage of noxious grasshoppers is four times as great as that of the useful ground beetles.

In considering the relation of the shrikes to agriculture, it must be remembered that one inhabits a fertile country where cultivation yields heavy crops, while the other lives in a northern region where agriculture amounts to very little. Therefore, the good or harm done by the northern butcherbird must be mainly accomplished when it migrates south into the United States. From the present limited investigation, it appears that the beneficial qualities of both shrikes outweigh the injurious. Furthermore, it is probable that when it is possible to study the summer food habits of the butcherbird, this species, like its southern relative, the loggerhead, will be found to be a destroyer of quantities of grasshoppers and other noxious insects.

NORTHERN SHRIKE OR BUTCHERBIRD.

The northern shrike is a bird of the Hudsonian zone, breeding from Labrador to Alaska, and visiting the United States in winter only, when its food supply fails at the North. During its winter sojourn it renders a threefold service by killing grasshoppers, English sparrows, and mice. The birds and mice together amount to 60 percent, and insects to 40 percent, of the food from October to April. Grasshoppers constitute one-fourth of the food, and are equal to twice the combined amounts of beetles and caterpillars.

Apparently no mineral or vegetable matter is intentionally swallowed. Indeed, its exclusively animal diet makes it, practically, a bird of prey, and therefore we must consider what animals it destroys.

BIRDS EATEN BY THE BUTCHERBIRD.

The Chippewa Indians call this shrike 'big cannibal bird,' and several instances of cannibalism are recorded. In one case a hungry butcherbird pounced upon and carried off his companion, which had been shot and laid on the top of a log cabin. The butcherbird, when impelled by extreme hunger, becomes very bold, and has been known to enter a room and decapitate a caged canary.

In the stomachs of the 67 butcherbirds examined 28 species of seed-eating birds were found. Of these 3 were tree sparrows, 5 juncos, and 7 English sparrows; the others could not be named with certainty. The tree sparrows and juncos were found in shrikes that had been taken in rural districts. On the other hand, English sparrows were found only in stomachs of birds that had been collected in cities.

In speaking of the enemies of the English sparrow, Prof. W. B. Barrows says:

> Probably the most useful bird in this respect is the northern shrike (*Lanius borealis*), which visits most of our northern cities in winter and feeds freely on the sparrow. At one time this shrike became so abundant on the Common and public parks in Boston that it threatened to destroy all the sparrows, but the shortsighted authorities kept a man busy shooting the shrikes, until several dozen had been killed, and the useless sparrows were considered safe.

It is to be hoped that in other cities this enemy of the sparrow will be protected instead of persecuted. If there were 6 butcherbirds in each of 20 New England cities, and each butcherbird killed 1 sparrow a day for the three winter months, the result would be a removal of 10,800 sparrows. Since 2 sparrows could raise under favorable conditions four broods of 5 each, the increase would be tenfold, so that those destroyed by the butcherbirds, if allowed to live, would have amounted at the end of the first year to 118,800, and at the end of the second year to 1,306,800 individuals. The shrike is at work every winter in the cities of the northern tier of States, killing the sparrows which tend to increase until they become so abundant that more are obliged to resort to the country for food. In a number of instances where English sparrows had been devoured, their stomachs, containing seeds and gravel, were found within the butcherbirds' stomachs. A golden-crowned kinglet's stomach also was detected, filled with fragments of a beetle and scores of tiny gnats. Mr. Frank M. Drew, in an article entitled 'Field Notes on the Birds of San Juan County, Colorado' (Bull. Nutt. Ornith. Club, vol. 6, p. 89), says that this shrike lives by foraging on little troops of titmice. Dr. G. S. Agersborg, of South Dakota, states (The Auk, vol. 7, p. 279) that it seems to follow the wake of the tree sparrows (*Spizella monticola*), and leaves in the spring at the same time they do. Prof. F. E. L. Beal while at Ames, Iowa, noted the butcherbird attacking birds only once, although he had time and again recorded their killing mice. In this exceptional case the victim was a downy woodpecker (*Dryobates pubescens*) which the shrike had hung in a crotch while devouring the brains. The most remarkable account of the butcherbird's not molesting birds also comes from Professor Beal at the same station. A shrike was perched on a telegraph wire above a rank weed patch which was all a-twitter with hundreds of native sparrows. Every now and then the shrike would leave the wire to scour the prairie, apparently hunting for mice, and then return to his perch. He paid no attention to the sparrows, and they showed no signs of apprehension.

Following is a list of birds that the butcherbird has been known to kill:

Chickadee (*Parus atricapillus*).[1]
Bush tit (*Psaltriparus*).
English sparrow (*Passer domesticus*).[2]
Tree sparrow (*Spizella monticola*).[2]
Snowflake (*Plectrophenax nivalis*).
Downy woodpecker (*Dryobates pubescens*).
Vireo (*Vireo* sp.).
Junco (*Junco hyemalis*).[2]
Kinglet (*Regulus satrapa*).[2]
Field sparrow (*Spizella pusilla*).[2]
Goldfinch (*Spinus tristis*).[2]
Siskin (*Spinus pinus*).[2]
Yellow-rumped warbler (*Dendroica coronata*).[2]
Mourning dove (*Zenaidura macroura*).
Cardinal (*Cardinalis cardinalis*).
Longspur (*Calcarius*).[3]
Shore lark (*Otocoris*).[3]

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[1] Dr. J. Dwight, jr.

[2] Identified in the laboratory.

[3] Ornithologist and Oologist.

MAMMALS EATEN BY THE BUTCHERBIRD.

The stomach of a shrike that has recently eaten a mouse is found to be filled with a large ball of fur, with bones in the center. It is impossible for these large masses to pass through the small intestine, therefore they are expelled through the mouth. A number of birds, including the European shrike (*Lanius excubitor*), are known to disgorge pellets after the manner of birds of prey.

Mice were found in one-third of the stomachs examined, constituting one-fourth of the food, and were eaten most frequently in March. Of these mice 15 were identified as follows: 1 white-footed mouse (*Peromyscus*), 1 harvest mouse (*Reithrodontomys*), and 8 meadow mice (*Microtus*). This last mouse is the one that oftenest falls a victim to hawks and owls. Mr. William Brewster, of Cambridge, Mass., states in The Auk (Vol. XI, p. 329) that he saw a shrike seize a large meadow mouse by the back, drag it across the snow, and then drop it. The mouse, instead of trying to escape, sprang at the shrike and drove it back several feet. Finally the bird, by several well-aimed passes, succeeded in intimidating the mouse, and then, as the latter turned to run away, caught it by the neck and worried it to death, as a terrier would a rat. The mouse was afterwards borne off in the shrike's claws and fixed in the fork of a tree. Meadow mice, besides consuming grass and grain, also girdle fruit trees, and the house mouse, in addition to wasting corn in the granary, wantonly destroys grain standing in the shock.

Dr. E. A. Mearns, United States Army, states in a letter that shrikes in Minnesota during March live exclusively upon meadow mice (*Microtus*), and Mr. W. L. Scott (The Auk, Vol. I, p. 158) cites an instance in which a butcherbird was caught in the act of giving chase to a chipmunk (*Tamias striatus*).

Carrion is sometimes eaten. Prof. F. E. L. Beal, while at Ames, Iowa, in January, 1880, saw a butcherbird fly over the brown frozen prairie to a carcass of a cow, where it lit on one of the ribs and greedily tore off shreds of the flesh.

INSECTS EATEN BY THE BUTCHERBIRD.

Active insects are much more liable than sluggish ones to fall victims to the butcherbird, because objects which at rest can not be discriminated are instantly seen when moving. Thus it happens that flying grasshoppers and running beetles form a large proportion of the food of this bird. Grasshoppers and crickets (*Orthoptera*), which are eaten during every month from October to April, form 24 percent of the total volume of food, and for October and November together these insect pests form more than half of the food. Compared with *Orthoptera*, the beetles (*Coleoptera*) eaten are of minor importance, amounting to only 6 percent of the food. More than half these beetles belong to the family *Carabidæ*, the members of which prey upon insect pests. Caterpillars were contained in one-fifth of the stomachs examined, and during the months of January and February amount to 8 percent of the volume of the stomach contents. Dr. A. K. Fisher collected in March two stomachs that were full of caterpillars. Even the bristly Isabella caterpillar is eaten, an object apparently as edible as a chestnut bur. Cutworms were found in several instances, but moths were seldom met with. Ants, wasps, flies, and thousand legs are sometimes eaten, and spiders constitute 3 percent of the food; but bugs (*Hemiptera*) were not detected during our laboratory investigations, though a cicada supposed to have been impaled by a shrike was found by Mrs. Musick, at Mount Carmel, Mo.

Important as is the study of the food of nestlings, it must, for lack of material, rest on the work of other writers. Audubon states that caterpillars, other insects and spiders, together with small fruits, form the first food of young butcherbirds. It seems odd that a bird which eats no fruit itself should feed its young on berries. The loggerhead shrike, as far as my investigation shows, neither takes vegetable food nor gives it to its young; and furthermore, our fruit-eating birds, so far as known, never begin by feeding their young on fruit.

The present investigation shows that beneficial birds form less than one-fourth of the food of the butcherbird. It also shows that the butcherbird, in addition to being an enemy of mice, is a potent check on the English sparrow, and on several insect pests. One-fourth of its food is mice; another fourth grasshoppers; a third fourth consists of native sparrows and predaceous beetles and spiders, while the remainder is made up of English sparrows and species of insects, most of which are noxious.

THE LOGGERHEAD SHRIKE.

The geographic races of the loggerhead shrike have almost identical habits, and consequently will be considered together. During the breeding season the loggerhead, the southern representative of the butcherbird, inhabits the United States, northern Mexico, and the southern part of the interior of Canada. It is smaller and differs in minor details of color: the lower mandible is black, while that of the butcherbird is yellowish; and the black bars on the side of the head meet across the forehead, but fail to do so in the butcherbird. In fall the loggerheads wander southward, but in spring they return to their breeding grounds and nest in thorny shrubs.

BIRDS EATEN BY THE LOGGERHEAD.

Only 7 birds were found in the 88 loggerhead stomachs examined. One of these was an English sparrow, another a tree sparrow, and most of the others, which were not specifically identified, were also seed-eating birds.

Following is a list of birds reported to have been killed by the loggerhead:

English sparrow (*Passer domesticus*).
Tree sparrow (*Spizella monticola*).
Yellow-winged sparrow (*Ammodramus savannarum passerinus*).
Song sparrow (*Melospiza fasciata*).
Western chipping sparrow (*Spizella socialis arizonæ*).[1]
White-throated sparrow (*Zonotrichia albicollis*).[2]
Young chicken.[3]
Canary (*Serinus canarius*).[4]
Chimney Swift (*Chætura pelagica*).[4]
Ground dove (*Columbigallina passerina terrestris*).
Bell's vireo (*Vireo belli*).[1]
Snow bunting (*Plectrophenax nivalis*).[5]
Blue-gray gnatcatcher (*Polioptila cærulea*).[1]

MAMMALS EATEN BY THE LOGGERHEAD.

From the laboratory investigation there is no evidence to show that shrews are eaten, but Mr. Robert Ridgway has seen shrews that had been impaled by the loggerhead. Mice are often found in stomachs of birds killed in winter, at which season they form 50 percent, and for the whole year 16 percent, of the food. The pretty white-footed mice are favorites. Bones, skin, and two tails of this mouse were taken from one stomach. The loggerhead is a good mouser during cold weather, but owing to its weaker bill is not so successful as the butcherbird in its battles with the large meadow mice.

Cases have been recorded where loggerheads ate carrion. Mr. William Lloyd, in an article entitled 'Birds of Tom Green and Concho counties, Texas' (The Auk, Vol. IV, 1887, p. 295), states that in the severe January of 1884 he found a loggerhead shrike so gorged from feeding on a dead sheep that it could not fly.

OTHER VERTEBRATES EATEN BY THE LOGGERHEAD.

Lizards were found in 6 of the 9 stomachs collected south of the latitude of Nashville, Tenn. One of the lizards was the so-called chameleon (*Anolis principalis*). Snakes, fish, and frogs are occasionally eaten. On this subject Mr. H. G. Gedney writes: * * * "I have often seen them (loggerheads) return to lizards and tree toads which they had impaled * * *. I saw a loggerhead attack a snake of the genus *Leptophis*, nearly two feet long, and after a sharp contest succeed in dispatching it." It is not at all uncommon for loggerhead shrikes to kill snakes. In The Osprey for April, 1897, is a picture of an impaled garter snake (*Eutænia sirtalis*) beside a loggerhead's nest, and several observers have told me that they attack snakes and impale their bodies. Prof. W. G. Johnson, of the Maryland Agricultural College, has observed the loggerhead impale snakes on a barbed-wire fence. At times loggerheads feed upon fish. The stomach of a bird killed in Utah on a cold winter's day contained nothing but minnow's bones; and Bachman speaks of the shrike's impaling fish that have been left by fishermen.

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[1] William Lloyd.
[2] William Palmer.
[3] Florida Dispatch.
[4] Robert Ridgway.
[5] W. H. Collins.

INSECTS EATEN BY THE LOGGERHEAD.

The larger part of the insect food of this shrike consists of *Orthoptera* (grasshoppers and crickets), and the remainder is principally beetles. In summer, when grasshoppers are abundant, the loggerhead does not seem to attack birds. The fact that in time of plenty more insects are killed and impaled than can be utilized indicates that the percentage of these pests destroyed is much greater than the laboratory examinations show. The same statement would not hold good in the case of the destruction of birds, because during cold weather when birds are killed there is a scarcity of food, and all the spoils of the chase are probably utilized. Grasshoppers and crickets were found in three-fourths of the stomachs examined, and 14 of the 88 shrikes had fed exclusively upon these pests. Most of the *Orthoptera* eaten are grasshoppers, though some crickets are taken. Most of the grasshoppers found in stomach contents are flying species, among which have been noted the dust-colored *Dissosteira carolina* which, when rising from the road, shows beautiful yellow underwings, and the red-legged grasshopper (*Melanoplus femur-rubrum*) which is so conspicuous in hay fields. The pellucid grasshopper (*Camnula atrox*), which is somewhat migratory, is frequently captured, and also an ugly grasshopper (*Hippiscus*). In Arizona Dr. Horn has seen loggerheads catch grasshoppers and impale them on cactus spines. One of the largest insects devoured by this bird is a sand cricket, the so-called Idaho devil. The mole cricket, likewise a large insect, is attacked and eaten by the shrikes of the southeastern United States. The fact that they take these enormous insects shows that whatever food becomes available in any locality is generally utilized.

Beetles and their larvæ are found in about one-fourth of the stomachs, and constitute 20 per cent of the bulk of the food. Most of the beetles are eaten in spring before grasshoppers become abundant. Half the beetles and their larvæ destroyed are useful carnivorous species that prey upon insect pests. Some of the largest of these beneficial beetles have been found stuck upon the splinters of the stump of a felled tree. There were taken from one loggerhead's stomach 112 jaws of the larvæ of a large predaceous beetle, and from another stomach the remains of the useful tiger beetle. It is probable that the killing of useful beetles is more detrimental to agricultural interests than the destruction of birds. Although half the beetles eaten are beneficial, most of the others are injurious. Among this latter class may be mentioned large, bright-colored, wood-boring beetles (*Buprestidæ*), with the adult beetles of wire worms, weevils, and some allies of the May beetle. There are also eaten some of the harmless species closely related to this last group of beetles, as for instance the little dung beetles (*Aphodius*) and the large green-and-gold tumblebug (*Phanæus carnifex*). Darkling (*Tenebrionidæ*) and carrion beetles (*Silphidæ*) are frequently caught, and the latter insects have been found stuck upon a barbed-wire fence.

The insect food of the loggerhead, like that of the butcherbird includes about 11 percent of caterpillars, wasps, and spiders. In the stomach of one bird was the abdomen of a large wasp with its sting still attached. That the loggerhead is given to catching large insects is shown by the fact that one stomach was distended with a large grasshopper (*Schistocerca americana*), another contained a mole cricket, and a third was filled with an enormous saw fly (*Urocerus*). This last wasp-like insect does much damage by puncturing trees, thus making an opening for wood-boring insects.

Loggerheads relish caterpillars; they destroy canker worms (*Geometridæ*), cut worms (*Noctuidæ*), and even bristly caterpillars (*Arctiidæ*); but as far as this investigation goes they have not been known to take adult *Lepidoptera*, although Bachman says he has seen them seize butterflies and moths on the wing. To complete the items of the invertebrate food there should be added crane flies, ants, dragon flies, May flies, thousand-legs, snails, and cray fish. These, though occasionally eaten, never form any significant percentage of the food.

To this account of the loggerhead shrike are added the following field notes kindly written for this paper by Mr. E. A. Schwarz, of the U. S. Department of Agriculture:

Insects impaled by Lanius ludovicianus excubitorides in southwestern Texas.

From April 24, 1896, the date of my arrival at San Diego, Duval County, Tex., up to May 21, I do not remember having seen any impaled insects. During this time the weather was extremely dry, but quite a number of large-sized insects abounded. On May 21 a copious rainfall occurred and brought out myriads of specimens of the Scarabæid genus *Canthon* (tumble bugs). These seem to be greatly relished by the shrikes, and large numbers of specimens could now be seen impaled every day. Other species of impaled insects observed at the time were *Pasimachus*, *Dicœlus*, and a single Hymenopter (*Glis*). No impaled grasshoppers were seen at this season.

The shrubs more especially selected by the birds are *Celtis pallida* and *Prosopis juliflora*, dead shrubs being preferred to living ones.

However, the number of impaled insects in early summer is small in comparison with that seen toward the end of October. Impaled grasshoppers abound now, but there is no lack of other terrestrial insects, especially Carabidæ. Some soft-bodied insects are also among them, notably various terrestrial spiders and larvæ of Carabidous Coleoptera. Finally, there are numerous lizards and horned toads. It was also then noticed for the first time that the barbs of wire fences are used for impaling insects.

Most of the impaled specimens are never eaten by the birds, and remain for many weeks on the thorns. It would seem that the bird has acquired the habit of impaling insects without having the intention of eating them.

FOOD OF NESTLING LOGGERHEAD SHRIKES.

A female parent and 6 half-grown young were collected for the purpose of ascertaining whether, as is commonly believed, young shrikes are fed upon song birds. Three-fourths of the contents of each of these stomachs were insects, mainly grasshoppers. Parts of a meadow mouse had been fed to 2 of the nestlings. Mr. F. H. King, who has made extended studies on the food of birds, cites an instance of a shrike of this species carrying a warbler to its young, but Mr. Ernest Seton Thompson, who has recently examined the stomachs of 4 fledglings, found no birds, but many beetles, grasshoppers, and bristly caterpillars. The caterpillars belonged to the family *Arctiidæ*, and were covered with spines. It is very important that the few birds which will eat such caterpillars should be rigorously protected.

SUMMARY.

The food of the butcherbird and loggerhead, as shown by 155 stomachs collected during every month in the year, and in an area extending from California to the Atlantic coast, and from Saskatchewan to Florida, consists of invertebrates (mainly grasshoppers), birds, and mice. During the colder half of the year the butcherbird eats birds and mice to the extent of 60 percent and ekes out the rest of its food with insects. In the loggerhead's food birds and mice amount to only 24 percent. It will readily be seen from the table on page 26 that the loggerhead's beneficial qualities outweigh 4 to 1 its injurious ones. Instead of being persecuted it should receive protection.

LIST OF INVERTEBRATES DESTROYED BY THE BUTCHERBIRD.

- *Orthoptera:*
    - Grasshoppers (*Acridiidæ*) { *Melanoplus.* / *Tettix.*
    - Crickets (*Gryllidæ*).
- *Coleoptera:*
    - Ground beetles (*Carabidæ*).
    - Tiger beetles (*Cicindelidæ*).
    - Darkling beetles (*Tenebrionidæ*).
- *Diptera:*
    - Flies.
- *Hymenoptera:*
    - Ants (*Formicidæ*).
    - Wasps.
- *Lepidoptera:*
    - Cut worms (*Noctuidæ*).
    - Bristly caterpillars (*Arctiidæ*).
- *Arachnida:*
    - Spiders.
- *Myriapoda:*
    - Thousand-legs (*Julus*).
- *Crustacea:*
    - Sand fleas (*Amphipoda*).

LIST OF INSECTS DESTROYED BY THE LOGGERHEAD.[1]

Orthoptera:
- Grasshoppers
  - *Acridiidæ*
    - *Melanoplus femurrubrum.*
    - *Camnula atrox.*
    - *Dissosteira carolina.*
    - *Schistocerca americana.*
  - *Locustidæ.*
- Crickets and mole crickets (*Gryllidæ*).

Coleoptera:
- Ground beetles (*Carabidæ*)
  - *Anisodactylus.*
  - *Amara interstitialis.*
  - *Lebia.*
  - *Harpalus.*
  - *Pterostichus.*
  - *Carabus ?.*
- Scarabæids
  - May beetles.
  - Tumblebugs
    - *Canthon.*
    - *Geotrupes.*
  - Dung beetles (*Aphodius hyperboreus*).
  - Flower beetles (*Euphoria*).
- Histerids (*Hister*).
- Longicorn beetles (*Cerambycidæ*).
- Rove beetles (*Staphylinidæ*).
- Tiger beetles (*Cicindelidæ*).
- Click beetles (*Elateridæ*) [*Melanotus*].
- Carrion beetles (*Silphidæ*)
  - *Silpha ramosa.*
  - *Necrophorus marginatus.*
- Weevils (*Rhynchophora*).
- Darkling beetles (*Tenebrionidæ*)
  - *Upis ceramboides.*
  - *Eleodes tricostata.*

Hemiptera:
- Bugs (*Heteroptera*).

Odonata:
- Dragon flies
  - *Agrion.*
  - *Libellula.*

Lepidoptera:
- Cutworms (*Noctuidæ*).
- Canker-worms (*Geometridæ*).
- *Arctiidæ.*
- *Hymenoptera:*
  - Ants
    - *Formicidæ* .... *Camponotus pennsylvanicus.*
    - *Myrmicidæ.*
  - Wasps (*Vespina, Sphecina, Urocerus*).
- *Diptera:*
  - Crane flies (*Tipulidæ*).
- *Ephemeridæ:*
  - May flies.

OTHER INVERTEBRATES DESTROYED BY THE LOGGERHEAD.

Spiders.
Snails.
Thousand legs.

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[1] Some of these insects are from records sent in by Mr. Ernest Seton Thompson.

Table showing percentages of principal elements of food of the butcherbird and loggerhead, calculated by volume.

Name.	Vertebrates.	Invertebrates.	Mammals.	Birds.	Other vertebrates.	Grasshoppers and crickets.	Spiders.	Wasps.	Caterpillars and moths.	Ground beetles.	Other beetles.	Month.	No. of stomachs.
Butcherbird	77	23	22	55	....	8	3	1	6	4	1	Dec., Jan., and Feb.	33
Loggerhead	76	24	55	14	7	13	1	....	2	4	6		14
Butcherbird	77	23	46	31	....	9	1	3	5	3	2	Mar. and Apr.	17
Loggerhead	20	80	9	9	2	24	9	4	11	14	18		16
Do	11	89	3	....	8	71	3	....	4	7	4	May and June	17
Do	2	98	....	....	2	67	2	4	1	5	19	July, Aug., and Sept	22
Butcherbird	27	73	11	16	....	57	4	....	6	4	2	Oct. and Nov.	17
Loggerhead	10	90	....	10	....	50	5	7	3	13	12		19
Butcherbird	60	40	26	34	....	24	3	2	6	4	1	Average Oct. to Apr., incl.	67
Loggerhead	28	72	16	8	4	39	4	3	4	9	13	Average for the whole year.	88

BULLETIN No. 10

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF BIOLOGICAL SURVEY

LIFE ZONES AND CROP ZONES

OF

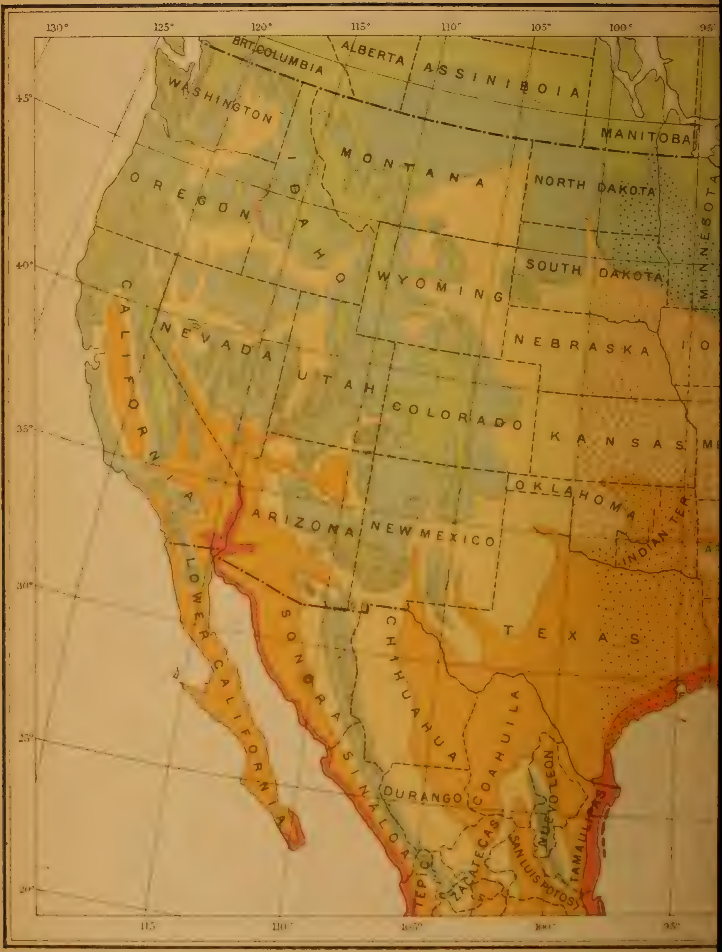
THE UNITED STATES

BY

C. HART MERRIAM

Chief, Biological Survey

WASHINGTON
GOVERNMENT PRINTING OFFICE
1898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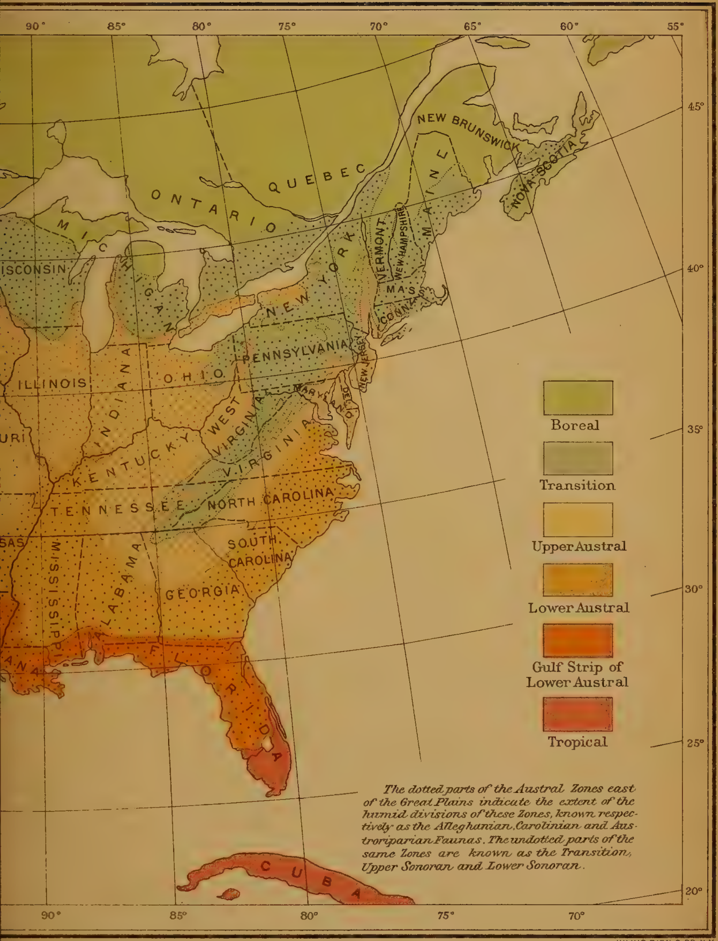
Corrected to December, 1897.

LIFE ZONES OF

C. HART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Upper Austral
Lower Austral
Gulf Strip of Lower Austral
Tropical

The dotted parts of the Austral Zones east of the Great Plains indicate the extent of the humid divisions of these Zones, known respectively as the Alleghanian, Carolinian and Austroriparian Faunas. The undotted parts of the same Zones are known as the Transition, Upper Sonoran and Lower Sonoran.

JULIUS BIEN & CO. N.Y.

UNITED STATES

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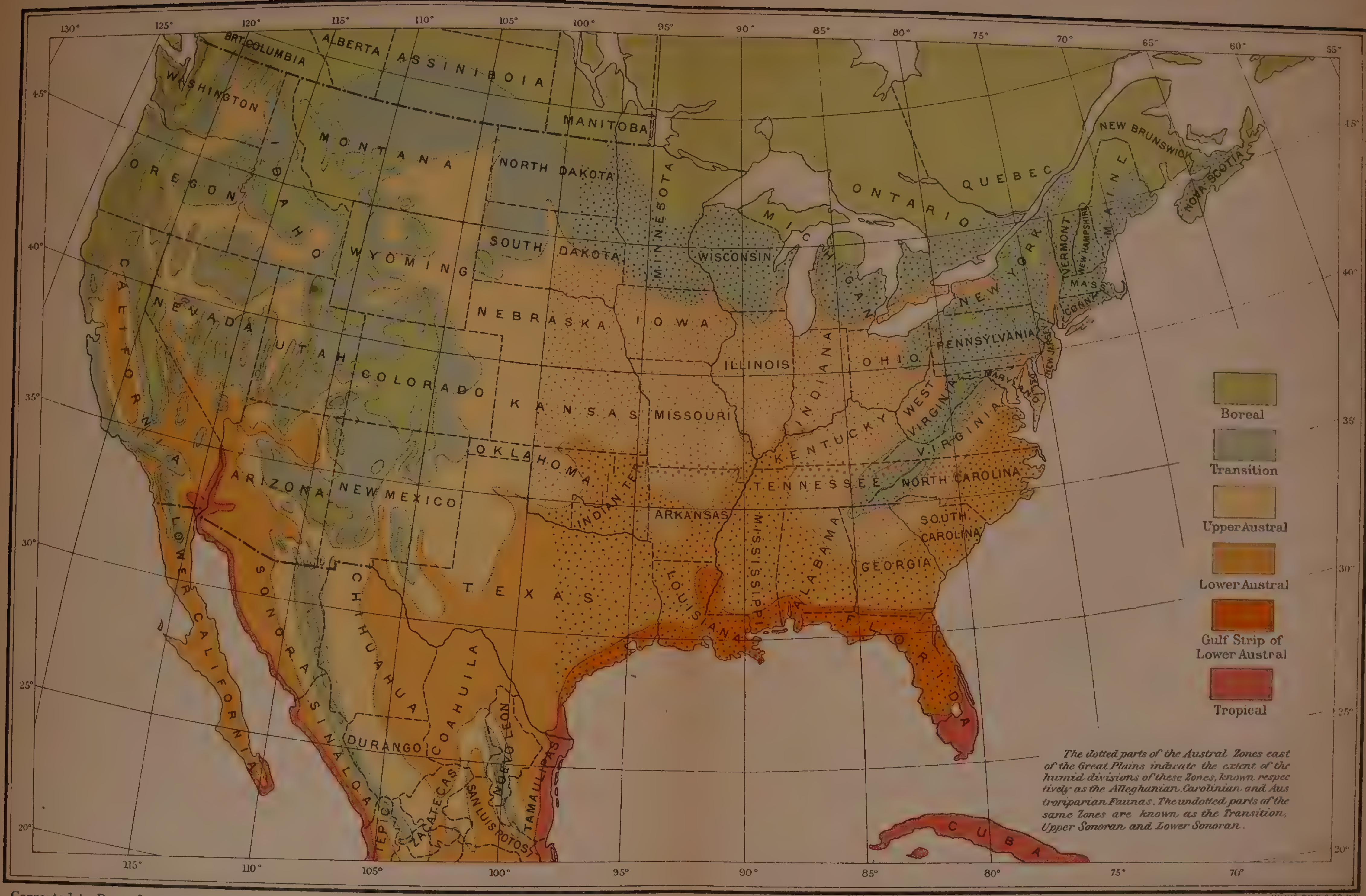

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Corrected to December, 1897.

JULIUS BIEN & CO. N.Y.

LIFE ZONES OF THE UNITED STATES

BY

C. HART MERRIAM.

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U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

LIFE ZONES AND CROP ZONES

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1898

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Biological Survey,
Washington, D. C., June 20, 1898.

Sir: I have the honor to transmit herewith for publication, as Bulletin No. 10 of this division, a report on the work of the Biological Survey in its relation to practical agriculture, comprising a reprint of the article on the subject in the Yearbook of the United States Department of Agriculture for 1897 and considerable additional matter. This report is accompanied by a new map of the life zones of the United States, corrected to December, 1897, and consists of four parts, as follows:

I. Relations of the Biological Survey to practical agriculture.

II. Life zones of the United States: Boundaries, native species, and important crops.

III. Laws of temperature control of the geographic distribution of animals and plants.

IV. Crop tables.

It is hoped that this report, with its accompanying zone map and crop lists, will serve to emphasize the extreme wastefulness of indiscriminate experimentation, by which hundreds of thousands of dollars are thrown away each year in futile attempts to make crops grow in areas totally unfitted for their cultivation.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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Map showing life zones of the United States .... Frontispiece.

INTRODUCTION.

For ten years the Biological Survey (and its predecessor, the Division of Ornithology and Mammalogy) has had small parties in the field traversing the public domain for the purpose of studying the geographic distribution of our native land animals and plants and mapping the boundaries of the areas they inhabit. The present report is intended to explain the relations of this work to practical agriculture and to show the results thus far attained—it does not deal with other investigations carried on by the Survey.

It was early learned that North America is divisible into seven transcontinental belts or *life zones* and a much larger number of minor areas or *faunas*, each characterized by particular associations of animals and plants. It was then suspected that these same zones and areas, up to the northern limit of profitable agriculture, are adapted to the needs of particular kinds or varieties of cultivated crops, and this has since been fully established. When, therefore, the natural life zones and areas, seemingly of interest only to the naturalist, were found to be natural crop belts and areas, they became at once of the highest importance to the agriculturist. A map showing their position and boundaries, so far as ascertained at the close of the field season of 1897, accompanies this report, and lists of the more important crops of each belt and its principal subdivisions are here for the first time published. The matter relating to the native animals and plants has been reduced to a fragmentary outline, for the reason that this branch of the subject is of comparatively little interest to the farmer and fruit grower.

Under the head 'Important crops,' and in the corresponding 'Crop tables' at the end of the report, great care has been taken to make the lists accurate and trustworthy *as far as they go*. One of the chief difficulties encountered is that nearly all of the published matter relating to the distribution of crops is arranged by political divisions, as States or counties, and consequently is of little assistance as a guide to climatic or zone requirements. Another difficulty is the over sanguine attitude of many fruit growers and horticultural societies, particularly in the West, where innumerable varieties are reported as succeeding in places where they have not been tested a sufficient length of time. The intention in the present report has been to omit doubtful records, and since reliable information from specific localities of known zone position is exceedingly scarce, it is obvious that the lists are very incomplete. They should be taken as a base on which to build.

Statistical information has been freely furnished by Mr. John Hyde, Statistician of the Department. The data on the distribution of cereals I have compiled from a study of the manuscript maps accompanying a report by Prof. C. S. Plumb, about to be published by the Biological Survey. The data on fruits and other crops have been obtained from various sources, published and unpublished. Among the former may be mentioned the 'Catalogue of Fruits' of the American Pomological Society (Bull. 6, Div. Pomology, U. S. Department Agriculture), reports of several State boards of horticulture, and reports of the State Board of Trade of California. Special information on Arizona has been contributed by Prof. J. W. Toumey; on Florida, by Mr. Herbert J. Webber; on California, by Prof. E. J. Wickson; on Washington, by Mr. Jesse Baker, and on the Snake River Valley at Lewiston, Idaho, and adjacent parts of Washington, by Mr. E. H. Libby, president of the Lewiston Water and Power Company, and Henry H. Spalding, of Almota, Wash. But most of all I am indebted to the courtesy of the Division of Pomology of the United States Department of Agriculture, and particularly to Mr. William A. Taylor, assistant pomologist, who has kindly gone over and corrected the various fruit lists with me and has made the nomenclature conform to the rules of the American Pomological Society. Without Mr. Taylor's invaluable assistance these lists would not have been fit for publication.

Corrections and additions are earnestly desired in order that subsequent editions of the report, which is intended to serve as a guide and index to the crop adaptations of the various life zones and areas, may be made more complete and useful. The list of miscellaneous crops here given is regrettably meager, and nothing whatever is said of the varieties of tobacco, tomatoes, eggplants, pumpkins, squashes, beans, pease, potatoes, or other garden vegetables. It is hoped the necessary data on these will be obtained in time for insertion in the next edition.

C. H. M.

LIFE ZONES AND CROP ZONES OF THE UNITED STATES.

PART I.

RELATIONS OF THE BIOLOGICAL SURVEY TO PRACTICAL AGRICULTURE.

The Biological Survey aims to define and map the natural agricultural belts of the United States, to ascertain what products of the soil can and what can not be grown successfully in each, to guide the farmer in the intelligent introduction of foreign crops, and to point out his friends and his enemies among the native birds and mammals, thereby helping him to utilize the beneficial and ward off the harmful kinds.

No fact is better recognized by thoughtful students of our resources than the need of diversifying our agricultural products, with a view not only to remedying the present unequal apportionment of standard crops throughout the United States, but also with a view to the introduction of new kinds. This is the more important because of the varying market values of standard crops from year to year, prices frequently falling so low as barely to cover cost of production, bringing hardship if not financial ruin to the producer. In order to obviate so far as possible the disastrous effects of such years it would seem the part of wisdom to be prepared with two or more crops, so that if one fails by reason of unsuitable seasonal conditions or low price the other can be depended on for sufficient revenue to bridge over the period of loss from failure of the first.

Farms so favorably situated that absolute reliance can be placed on a single crop, or so little diversified that all parts are equally fitted for this crop, are few and far between; and even in such cases there is danger of overproduction. As a rule, if the major part is well adapted for corn, wheat, cotton, sugar, or tobacco, the crop chosen is subject to material fluctuations in yield and value, and minor areas are better fitted for some other use.

NEED OF DIVERSIFICATION OF CROPS.

The Statistician of the Department, in his last report to the Secretary, calls attention to the marked geographic concentration of agricultural productions, and points out that "twenty-five States, or just half the total number, produce 98 per cent of the cotton, 95 per cent of the corn, 95 per cent of the barley, 93 per cent of the oats, and from eight-tenths to nine-tenths of the wheat, rye, buckwheat, tobacco, potatoes, and hay produced in the entire country." This certainly is an unfortunate state of affairs, and one which, in the light of present knowledge of crop adaptations, seems unnecessary. At the same time, it is well to keep in mind the distinction between crops raised for home consumption and those raised for export. If, for instance, the twenty-five States and Territories now producing collectively less than 5 per cent of the total output of cereals can, by selecting proper varieties, grow enough for their own use, they may be able to raise for export fruits or other crops far more valuable to them than an excess of cereals.

For several years prior to 1897[1] the price of wheat in the North and West was so low as hardly to cover the cost of harvesting, while in the Southern States not enough was raised for local consumption, and the price was correspondingly high. Thus, in 1894 the price of wheat on the farm in the Dakotas, Oregon, and Washington ranged from 39 to 46 cents per bushel, while in South Carolina, Alabama, and Georgia it brought from 76 to 87 cents, and in Arizona $1. If a wheat can be found which may be depended upon to mature a good yield on suitable soils in the Southern States great benefit to the people should accrue therefrom. Recent investigations carried on in the Biological Survey by Prof. C. S. Plumb show that Fultz wheat and the spring or May wheats (including red May, early May, late May, big May, and others) may be grown successfully, except in the lowlands, in what is known as the Austroriparian zone, a belt which covers the greater part of South Carolina, Georgia, Alabama, Mississippi, Louisiana, and central Texas; and that Sonoran and Australian wheat do well in the Lower Sonoran belt in Arizona and southern California. Similarly, oats, in the main a Northern crop, has been found to do well in the Austroriparian belt of the Southern States if proper varieties are chosen; and these varieties are the Burt and Red Rust Proof. In the case of corn, Moseby's Prolific, Golden Dent, and White Gourd Seed seem well adapted to the same belt. So there appears to be no reason why cereals can not be grown in the Southern States in quantities more than sufficient for local consumption.

Cotton is the staple crop of the South, far exceeding all others in money value. But during 1897 the price of cotton was so low as to yield no profit, while at the same time wheat was so high that if a fair division of acreage had been made between the two, the Southern planters would have realized handsome profits instead of suffering financial distress. Attention must be called also to the fact that in the face of the very large crop and extreme low price of cotton in 1897, when our export amounted to $212,640,769 (and similarly in 1894, when we exported $210,000,000 worth), enormous quantities were imported from Egypt. This, while inferior to our Sea Island cotton, is of higher grade than our ordinary product and is used "for goods requiring smooth finish and high luster. It gives to fabrics a soft finish somewhat like silk." During the fiscal year 1896 the value of the Egyptian cotton imported into this country was more than $5,000,000, and in 1897, $4,277,618. This brings up the important question whether we can not, with the aid of irrigation, raise these high-grade varieties in certain parts of the arid Southwest—in southern Arizona and the desert region of southern California.

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[1] In 1897 the price of wheat was so high that in Oregon and Washington the farm value was 70 cents per bushel, and the crop was so large (more than 38,000,000 bushels) that its farm value in Washington was $13,684,761, and in Oregon $13,071,622, or a total for the two States of nearly $27,000,000.

SEA ISLAND AND EGYPTIAN COTTON FOR NEW SECTIONS.

The history of Sea Island cotton is interesting, as showing how the intelligent introduction and cultivation of choice crops in suitable climatic areas may yield rich returns. Dr. Walter H. Evans states that the Sea Island cotton, whose fiber is so highly prized, "is indigenous to the Lesser Antilles, and probably to San Salvador, the Bahamas, Barbados, Guadeloupe, and other islands between 12° and 26° north latitude. By cultivation it has been extended throughout the West Indies, the maritime coast of the Southern States, Central America, Puerto Rico, Jamaica, etc., southern Spain, Algeria, the islands and coast of western tropical Africa, Egypt, Island of Bourbon, East Indies, Queensland, New South Wales, etc. It may be cultivated in any region adapted to the olive and near the sea, the principal requisite being a hot and humid atmosphere; but the results of acclimatization indicate that the humid atmosphere is not entirely necessary if irrigation be employed, as this species is undoubtedly grown extensively in Egypt."

Although the area in which Sea Island cotton is produced in the United States is very small, and although a large quantity is manufactured in our country, still the value of the crop exported amounted in 1894 to nearly $3,000,000, in 1896 to $3,816,216, and in 1897 to $4,078,044. It is quite probable that both Sea Island and Egyptian cotton could be cultivated with profit in parts of southern California and southwestern Arizona.

PROFITABLE CROPS FOR DIFFERENT CLIMATES.

But wheat and cotton are not the only crops to be grown with advantage in the South, for the list of fruits, fiber plants, and other agricultural products fit for the climatic conditions of the Austroriparian belt is a long one, and a wise selection with reference to home consumption and convenient markets is bound to place agriculture in the Southern States on a very different plane from that which it now occupies.

In northern New York and Wisconsin[1] the dairying industry is one of the chief sources of revenue, and cheese is a staple product. In years like the present, when cheese sells at the factory for 8 or 9 cents—and still worse a few years ago, when it sold for 4 cents—the farmer is left at the end of the season without return for his labor. Yet, most of the lands now devoted almost exclusively to dairying are situated in the sugar-beet belt, and are also adapted to several excellent varieties of wheat and other crops to which little or no attention is now given.

WHAT THE FARMER NEEDS TO KNOW.

The farmers of the United States spend vast sums of money each year in trying to find out whether a particular fruit, vegetable, or cereal will or will not thrive in localities where it has not been tested. Most of these experiments result in disappointment and pecuniary loss. It makes little difference whether the crop experimented with comes from the remotest parts of the earth or from a neighboring State, the result is essentially the same, for the main cost is the labor of cultivation and the use of the land. If the crop happens to be one that requires a period of years for the test, the loss from its failure is proportionately great.

The cause of failure in the great majority of cases is climatic unfitness. The quantity, distribution, or interrelation of heat and moisture may be at fault. Thus, while the total quantity of heat may be adequate, the moisture may be inadequate, or the moisture may be adequate and the heat inadequate, or the quantities of heat and moisture may be too great or too small with respect to one another or to the time of year, and so on. What the farmer wants to know is *how to tell in advance* whether the climatic conditions on his own farm are fit or unfit for the particular crop he has in view, and what crops he can raise with reasonable certainty. It requires no argument to show that the answers to these questions would be worth in the aggregate hundreds of thousands of dollars yearly to the American farmer. The Biological Survey aims to furnish these answers.

MAPPING AGRICULTURAL REGIONS.

From the study of the geographic distribution of our native animals and plants it has been learned that the United States may be divided into seven transcontinental belts and a number of minor areas, each of which is adapted to particular associations of animal and vegetable life. It has been found also that each of these belts and minor areas, except the coldest, is adapted to the needs of particular agricultural products, and that the distribution of native animals and plants may be coordinated with the successful distribution of cultivated crops. In other words, the study of the geographic distribution of our native or indigenous fauna and flora has resulted in the establishment of a number of agricultural belts, each of which comprises several minor divisions fit for particular varieties of fruits, cereals, and breeds of live stock.

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[1] In 1890 New York produced 48.3 per cent and Wisconsin 21.3 per cent of the total output of cheese for the country. The New York output in that year was 124,086,524 pounds.

Through the intelligent efforts of man the slow processes of nature have been hastened, so that most fruits and cereals have been made to yield varieties adapted to a diversity of climatic conditions. The happy outcome of this artificial selection is that, while certain varieties of wheat, oats, corn, apples, pears, grapes, and so on, thrive only in certain limited areas, different varieties thrive in other areas, a very large proportion of crops having varieties fit for each of the natural agricultural belts of the country. The same is true, though perhaps in less degree, of poultry and live stock.

The Biological Survey is engaged in tracing with as much precision as possible the actual boundaries of these belts and areas, in preparing lists of the native or indigenous species, and of the fruits, grains, vegetables, and other agricultural products that are adapted to each. In this undertaking it aims to point out such exotic agricultural and horticultural products as, from their importance in other lands, are likely to prove of value if introduced on fit soils and under proper climatic conditions. In view of the fact that all of the climatic life zones of the world, except the hottest tropical, are represented in our own country, there can be little doubt that an intelligent study of the agricultural products and adaptations of distant lands will result in the discovery of fruits, vegetables, fibers, farm crops, and breeds of stock which may be introduced into the United States not only with profit, but which by diversifying our products and leading to the development of new industries will render our agricultural resources far more stable and certain.

The colored maps prepared by the Biological Survey furnish the first rational basis the American farmer and fruit grower has ever had for the intelligent distribution of seeds and the only reliable guide he can find in ascertaining beforehand what crops and fruits are likely to prove successful on his own farm, wherever it may be located. These maps, in connection with the work of the Entomologist, show also the belts along which noxious insects are likely to spread, forewarning the husbandman of impending danger.

In studying crops with relation to the zones or areas in which they may be most profitably cultivated considerable progress has been made. The results of an investigation of the zone adaptations of several hundred varieties of fruits and nuts form a part of the present report, and by cooperation with Prof. C. S. Plumb, director of the agricultural experiment station at Lafayette, Ind., the more important results of a similar study of the varieties of corn, wheat, and oats are also given.

DEVELOPMENT OF AGRICULTURE IN CALIFORNIA.

The history of the development of agriculture in California affords an excellent example of the changes in staple products that come with increased knowledge as to the fitness of particular areas for particular crops. In the early days California was distinctly a grazing State, and hides and wool were the chief exports. Then wheat came to the front, and soon formed the staple product. Later it was learned that large areas were particularly well suited to the needs of fruits, and the fruit industry rapidly grew, until at the present time it exceeds even the wheat crop in money value. But the fruits from which so large a revenue is now derived are only in part those first introduced. Fifteen years ago wine grapes were perhaps the most important fruit; now they are of secondary consequence. For a time deciduous fruits were the principal ones deemed worthy of attention; now citrus fruits are of even greater value, the output of oranges and lemons in 1896 being 3,780,000 boxes. Almonds, walnuts, olives, and raisins have also come to be important crops. Twenty-five years ago all our raisins were imported; now California produces annually from 90,000,000 to 100,000,000 pounds.

The development of the prune industry is instructive as an illustration of a common class of cases where products worth hundreds of thousands of dollars annually to a single State have been introduced by chance rather than as a result of scientific study. The first prune cuttings are said to have been brought from France, along with cuttings of grapes and other fruits, by a Frenchman who settled at San Jose about the end of 1856. For some years little was thought of this introduction, and it was not until 1880 and 1881 that serious attention was given the cultivation of prunes. But from 1893 until the present year the annual output in dry fruit has ranged from 44,780,000 to 64,500,000 pounds.[1]

It is hard to resist the temptation to dwell on the marvelous expansion of the fruit industry that has taken place in California since the climatic adaptations of her various agricultural belts began to be understood; but for present purposes a statement of the exports of a few of her many products for the year 1895 will suffice to give a fair idea of the magnitude this industry has attained. In 1895 California shipped 6,625 carloads of fresh deciduous fruits; dried fruits, 6,132 carloads; raisins, 4,638 carloads; canned fruits, 3,129 carloads; citrus fruits (mainly oranges), 11,582 carloads;[2] nuts, 1,333 carloads; wine and brandy, 8,056 carloads.[3]

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[1] Statistics from California Fruit Grower.

[2] Figures from Fifth Biennial Rept. California State Board of Agriculture, 1896.

[3] From California State Board of Trade.

THE ARID REGIONS.

While considerable progress has been made in ascertaining what agricultural products are adapted to the climatic conditions of southern California and southern Arizona, this has been done at great cost, and nothing like a complete knowledge of the subject has been attained. Before this will be possible the life zones and their subdivisions must be accurately mapped and corresponding arid areas in Africa, Arabia, Persia, India, Chile, and Australia must be studied with reference to agricultural productions which might be introduced with profit in proper zones in our arid Southwest. Nature has not been overgenerous in the distribution of water in this part of our country, but she has been lavish in her gifts of soils and climates. The fruit growers of California were long in finding out that their State comprises all of the agricultural belts of America except the humid tropical, and that its different areas are naturally adapted to a great diversity of agricultural and horticultural products; and even at the present day few realize that in the southern half of the State hundreds of farms might be so laid out with reference to the mountain slopes that each would embrace sections of all the agricultural belts, enabling the fortunate husbandman to produce not only early and late ripenings of small fruits and garden vegetables, but also an astounding diversity of crops, from the apples, cherries, potatoes, and hardy cereals of the upper Transition and lower edge of the Boreal belts, to the oranges, lemons, almonds, olives, and cotton of the Lower Sonoran zone, and in certain localities the pineapple, date, and citron of the arid Tropical areas. It is probably not too much to say that an accurate map of the agricultural belts of California in the early days would have saved the State in the aggregate millions of dollars that have been expended in finding out what crops are best adapted to particular areas, and although much has now been learned by persistent and costly experiments, such a map would still be of very great value.

SPECIAL VALUE OF NARROW EXTENSIONS OF FAUNAS.

In looking at the map of the life zones (see frontispiece), it will be seen that nearly all of the belts and areas send out long arms which penetrate far into the heart of adjoining areas. When such arms occupy suitable soils in thickly inhabited regions, so that their products may be conveniently marketed, they are of more than ordinary value, for the greater the distance from its area of principal production a crop can be made to succeed, the higher price it will command. Hence, farms favorably situated in northern prolongations or islands of southern zones, or in southern prolongations or islands of northern zones, should be worth considerably more per acre than those situated within normal parts of the same zones. The obvious reason is that by growing particular crops at points remote from the usual sources of supply, and at the same time conveniently near a market, the cost of transportation is greatly reduced and the profit correspondingly increased.

Among the numerous faunal arms which penetrate adjacent belts are the Hudson, central New York, and Michigan extensions of the Carolinian fauna, and the arms of the Lower Sonoran fauna which occupy the valleys of the Pecos and Rio Grande in New Mexico and the valley of the Lower Virgin in Utah. The latter is a good case for illustration. It is not only the sole Lower Sonoran area in Utah, but lies nearly 300 miles in a straight line, and a little more than 1,000 miles by railroad, from the nearest point where similar crops and fruits are commercially produced. It is an insular pocket or basin, completely hemmed in by mountains, and marks the extreme northeastern extension of the typical Sonoran desert fauna and flora. The creosote bush, mesquite, desert willow, Gregg acacia, and other Sonoran shrubs, and the Gambel quail, Le Conte and crissal thrashers, mocking bird, cactus wren, yellow-headed tit, Abert chewink, black phainopepla, vermilion flycatcher, and Texas nighthawk serve as a guide to its faunal position. The valley is traversed by the Virgin River and its tributary, the Santa Clara, which, together with copious springs, afford water for irrigation. It contains the Mormon settlements St. George, Santa Clara, Toquerville, and a few others of smaller size, with an aggregate population of about 3,000. Among the important products are cotton, tobacco, raisin grapes, almonds, olives, and figs; and among the ornamental shade trees are the pepper tree, tobacco tree, and China tree or Pride of India. The fertility of the soil is marked and the limit of its agricultural capacity, measured either by number of varieties or quantity of output, is still far in the future. Nevertheless, present production greatly exceeds the possibilities of local consumption, as shown by the cotton crop, which, for the year 1896–97, was no less than 123 bales of 500 pounds each, and was worth $4,305.[1] A feature of special interest in relation to the future possibilities of the valley is the fact that the yield of cotton per acre is very much higher than in any other State of the Union, and more than double that of the Gulf States. What is true of cotton is true in greater or less degree of fruits and other crops. There can be little question, therefore, that when railroad connection with northern Utah is established, the St. George Valley is bound to play an important part in the history and commercial prosperity of the young State.

The case of this remote valley brings into prominence the necessity for studying a much neglected subject, and one on which profitable agriculture very largely depends. It is not enough to succeed in growing crops well adapted to a particular locality, for bountiful crops are of little value unless they can be profitably marketed. But in order to reach the best markets it is necessary to ascertain the prices various products bring from year to year in different parts of the country, to make quantitative studies of production and consumption, to avoid overproduction, to study statistics of our imports and exports, and give thoughtful attention to questions of transportation; in short, to study commercial geography, at least so far as it relates to the products of one's own farm.

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[1] Statistics from John Hyde, Statistician, Dept. of Agric., in Circ. 8, Div. of Statistics.

The number and value of the exotic crops now grown successfully in the United States, swelling our revenue by many millions of dollars, is a monument to the industry, perseverance, and determination of the American people, but affords little clue to the multitude of failures and the enormous sums of money lost in experimentation. And it must be admitted that a very large proportion of these costly experiments have been conducted blindly, or at least without the aid of the scientific knowledge so necessary to success. As Professor Hilgard states in a recent report, "the farmer is left to his own devices to find his way as best he may; and we grope along laboriously gathering driblets of information here and there, and gradually, tentatively putting them together into a more or less connected whole." It is not so with other industries. Railroad corporations planning new lines study topographic maps and employ skilled engineers that they may ascertain the most feasible routes; capitalists having in view the purchase of mining properties employ experienced mineral experts that they may learn the direction, extent, and value of the mineral-bearing rocks; manufacturers employ not only skilled artisans, but also expert machinists, chemists, and electrical engineers that their apparatus and methods may yield the fullest returns. But the farmer in his struggle with the soil has none of these resources, and as a rule has little capital to risk in experiments.

The Biological Survey aims to assist him by laying before him maps of the agricultural belts and their subdivisions, with lists of the crops suited to each. These maps, studied with reference to the commercial availability of the different agricultural areas, including the various arms or extensions of the life zones, and with due respect to the density of population and facilities for transportation, are believed to contain much that will be found useful to the progressive student of agriculture.

PART II.

LIFE ZONES OF THE UNITED STATES: BOUNDARIES, NATIVE SPECIES, AND IMPORTANT CROPS.

The continent of North America may be divided, according to the distribution of its animals and plants, into three primary transcontinental regions—Boreal, Austral, and Tropical.

The *Boreal region* (colored green on the map) covers the whole of the northern part of the continent, from the polar sea southward to near the northern boundary of the United States, and farther south occupies a narrow strip along the Pacific coast and the higher parts of the three great mountain systems, the Sierra-Cascade Range, the Rocky Mountains, and the Alleghanies.

The *Austral region* (colored blue, yellow, and brown on the map) covers the whole of the United States and Mexico except the Boreal mountains and Tropical lowlands.

The *Tropical region* (colored red on the map) covers the southern part of the peninsula of Florida, the greater part of Central America, the lowlands of southern Mexico south of the table-land, and a narrow strip on each side of Mexico, which follows the coast northward into the United States.

The fauna and flora within each of these three great regions are not homogeneous, but present marked differences, which have led to the subdivision of each region into a number of minor belts or areas, characterized by particular associations of animals and plants. Thus, the *Boreal region* is divided into three transcontinental belts or zones, known respectively as the Arctic, Hudsonian, and Canadian; the *Austral region*, into three transcontinental belts, known as the Transition, Upper Austral, and Lower Austral. The *Tropical region* is likewise divisible, but the tropical areas within the United States are of such small extent that the divisions need not be here considered. Hence, in North America north of southern Mexico, the total number of transcontinental life zones is seven, of which three are Boreal, three Austral, and one Tropical. Beginning at the north, these zones may be described as follows:

1. THE ARCTIC-ALPINE ZONE.

The Arctic or Arctic-Alpine zone lies above the limit of tree growth and is characterized by such plants as the arctic poppy, dwarf willow, and various saxifrages and gentians. In the far north the snow bunting, snowy owl, ptarmigan, polar bear, arctic fox, polar hare, lemmings, musk ox, and barren-ground caribou or reindeer, are characteristic animals. Within the United States the Arctic-Alpine zone is restricted to the area above timber-line on the summits of high mountains. It is inhabited by arctic-alpine plants and animals, and is far too cold for agriculture.

2. THE HUDSONIAN ZONE.

The Hudsonian zone comprises the northern part of the great transcontinental coniferous forest—a forest of spruces and firs stretching from Labrador to Alaska—and the upper timbered slopes of the higher mountains of the United States and Mexico. In the north it is inhabited by the wolverine, woodland caribou, moose, rough-legged hawk, great gray owl, great northern shrike, pine bullfinch, white-winged crossbill, white-crowned sparrow, and fox sparrow. In the eastern United States the Hudsonian zone is restricted to the cold summits of the highest mountains, where it occurs in the form of a chain of widely separated islands reaching from northern New England to western North Carolina. In the western United States it covers the higher slopes of the Rocky Mountains and the Sierra-Cascade system, and is the home of the mountain goat, mountain sheep, coney or pika, alpine flying squirrel, Clark's crow or nutcracker, evening grosbeak, and Townsend's solitaire. Like the preceding, this zone is of no agricultural importance.

3. THE CANADIAN ZONE.

The Canadian zone comprises the southern part of the great transcontinental coniferous forest of Canada, the northern parts of Maine, New Hampshire, and Michigan, a strip along the Pacific coast reaching as far south at least as Cape Mendocino in California, and the greater part of the high mountains of the United States and Mexico. In the East it covers the Green Mountains, Adirondacks, and Catskills, and the higher mountains of Pennsylvania, West Virginia, Virginia, western North Carolina, and eastern Tennessee. In the mountains of the West it covers the lower slopes in the north and the higher slopes in the south. In the Rocky Mountain region it appears to reach continuously from British Columbia to west central Wyoming; and in the Cascade Range, from British Columbia to southern Oregon, with a narrow interruption along the Columbia River. Among the many characteristic mammals and birds of the Canadian zone are the lynx, marten, porcupine, northern red and pine squirrels, varying and snowshoe rabbits, star nose, Brewer's and Gibb's moles, water shrew, voles, and long-tailed shrews of various species, northern jumping mice, Belding's and Kennicott's ground squirrels, white-throated sparrow, Blackburnian, yellow-rumped, and Audubon's warblers, olive-backed thrush, three-toed woodpeckers, spruce and dusky grouse, crossbills, and Canada jays. Counting from the north, this zone is the first of any agricultural importance. Wild berries—as currants, huckleberries, blackberries, and cranberries—grow in profusion, and the beechnut (in the East) is an important food of the native birds and mammals. In favored spots, particularly along the southern border, white potatoes, turnips, beets, and the more hardy Russian apples and cereals may be cultivated with moderate success.

4. THE TRANSITION ZONE.

The Transition zone (colored blue on the map) is the transcontinental belt in which Boreal and Austral elements overlap. From New England to the northern Rocky Mountains its course is fairly even and regular, but west of the Great Plains it is tortuous and irregular (see map). The zone as a whole is characterized by comparatively few distinctive animals and plants, but rather by the occurrence together of southern species which here find their northern limit and northern species which here find their southern limit. It may be subdivided into three faunal areas, which, although grading into one another, are in the main strikingly different: (*a*) An eastern humid or *Alleghanian area;* (*b*) a *western arid area;* (*c*) a *Pacific coast humid area.* In the Transition zone we enter from the north the true agricultural part of our country, where many vegetables, the sugar beet, chicory, oats, and numerous varieties of apples, plums, cherries, pears, grapes, white potatoes, and cereals attain their highest perfection. These will be considered more in detail under the subdivisions of the zone.

(*a*) The Alleghanian Faunal Area.

The eastern humid or *Alleghanian* area comprises the greater part of New England, southeastern Ontario, New York, Pennsylvania, Michigan, Wisconsin, Minnesota, eastern North Dakota, northeastern South Dakota, and the Alleghanies from Pennsylvania to Georgia. Its fauna and flora are not homogeneous, but point to an important subdivision west of Lake Michigan, where numerous species occur that do not inhabit the area east of this lake. A glance at the accompanying list of apples, where a cross in front of the variety indicates its absence from Wisconsin and Minnesota, may be taken as an index to the horticultural importance of this Upper Mississippi subdivision. In the Alleghanian faunal area the chestnut, walnut, oaks, and hickories of the South meet and overlap the beech, birch, hemlock, and sugar maple of the North; the Southern mole and cottontail rabbit meet the Northern star-nosed and Brewer's moles and varying hare, and the Southern bobwhite, Baltimore oriole, bluebird, catbird, chewink, thrasher, and wood thrush live in or near the haunts of the bobolink, solitary vireo, and the hermit and Wilson's thrushes. Several native nuts, of which the beechnut, butternut, chestnut, hazelnut, hickory nut, and walnut are most important, grow wild in this belt. Of these, the chestnut, hickory nut, and walnut come in from the South (Carolinian area) and do not extend much beyond the southern or warmer parts of the Alleghanian area.

Crops of the Alleghanian Faunal Area.

Varieties prefixed by a cross (+) do not thrive in the Upper Mississippi section of the Transition zone (Wisconsin, Minnesota, and the eastern Dakotas), except in eastern Wisconsin in the vicinity of Green Bay. Those followed by the letters (*n*) or (*s*) in this and the following lists are practically restricted, respectively, to the northern or southern parts of the areas under consideration. Similarly the letter (*h*) indicates that the variety is confined to the hottest parts of the zone and belongs more properly to the zone below. Credit is due to Mr. William A. Taylor for marking the fruits in accordance with this plan. The numerals (*2*) and (*3*) indicate that the cereals thus marked are second or third rate in the area under consideration.

CEREALS.

Wheat.

Australian (*3*).
+Clawson.
Fultz (*3*).
Ladoga.
Red Fife.
Saskatchewan Fife.
Scotch Fife.

Oats.

+American Banner.
Black Tartarian.
Lincoln.
Welcome.
White Russian.

Corn.

Angel of Midnight.
+Canadian Eight-Row Yellow Flint.
King Philip.
Longfellow.
Pride of the North.
Squaw (*2*).
Stowell Evergreen (*2* and local).

Barley.

Rye.

Buckwheat.

FRUITS.[1]

Apples.

Alexander.
+Bailey *Sweet* (*s*).
+Baker.
+Baldwin.
+Benoni (*s*).
+Bietigheimer (*s*).
+Blenheim.
+Blue Pearmain.

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[1] The nomenclature of fruits is that adopted by the American Pomological Society (Bull. 6, Div. Pomology, U. S. Dept. Agriculture, 1897). Synonyms (indicated by parenthesis) and all descriptive terms which will be eliminated eventually, are printed in italics. A comma indicates a transposition of part of the name.

FRUITS—continued.

Apples—Continued.

+Bullock (*American Golden Russet*).
+Canada Reinette.
+Chenango (*s*).
+Clyde *Beauty*.
+Cogswell (*s*).
+Danvers (*s*).
+Domine (*s*).
+Dutch Mignonne (*s*).
+Dyer (*Pomme Royal*) (*s*).
+Early Harvest.
+Early Ripe (*s*).
+Early Strawberry (*s*).
+Esopus *Spitzenburg*.
+Ewalt (*s*).
+Fall Pippin.
+Fameuse.
+Garden Royal.
+Golden Russet.
+Golden Russet (N. Y.) (*s*).
+Golden Sweet.
+Gravenstein.
+Green Sweet.
Haas (*Fall Queen*) [Mississippi Valley].
+Hightop *Sweet*.
+Hubbardston.
+Hunt *Russet*.
+Jefferis (*s*).
+Jefferson County.
+Jewett *Red*.
+Jonathan (*s*).
+Keswick (*s*).
Longfield.
+Lowell (*s*).
+McIntosh.
McMahon.
+Maiden Blush (*s*).
+Margaret, *Early Red* (*s*).
+Melon, *Norton* (*s*).
+Minister.
+Montreal Peach.
+Moore Sweet (*s*).
+Mother (*s*).
+Newtown Spitzenburg (*s*).
+Northern Spy.
+Ohio Nonpareil (*s*).
Oldenburg, *Duchess of*.
+Ontario.
+Peck *Pleasant*.
+Perry Russet.
Pewaukee.
+Pomme Gris.
+Porter (*s*).
+Primate (*s*).
+Pumpkin Sweet (*Pound Sweet*).
+Rambo (*s*).
+Red Astrachan.
+Red Canada.
+Rhode Island *Greening*.
+Ribston.
+Rolfe.
Roman Stem.
+Roxbury.
+Saint Lawrence.
+Scott Winter.
+Shiawassee.
+Sops of Wine.
+Sterling (*American Beauty*).
+Summer Pearmain (*s*).
+Sutton.
+Swaar (*s*).
Tetofski.
+Tolman *Sweet*.
+Tompkins King.
+Twenty-Ounce.
+Vandevere (*s*).
+Wagener.
Wealthy.
Westfield.
+Williams *Favorite*.
+Wine, *Hays* (*s*).
Wolf *River*.
Yellow Transparent.

Crab apples.

Beach.
Brier.
+Elgin.
Excelsior.
Gibb.
+Hyslop.
Martha.
Marengo.
Minnesota.
Montreal.
Orange.
Red Siberian.
Transcendent.
+Van Wyck.
Whitney *No. 20*.
Yellow Siberian.

FRUITS—continued.

Cherries.

+Archduke.
Bessarabian.
+Black Heart (*s*).
+Buttner, *Yellow* (*s*).
+Choisy, *Belle de.*
+Coe *Transparent* (*s*).
+Donna Maria (*s*).
+Downer (*s*).
+Dyehouse (*s*).
+Eagle, *Black* (*s*).
+Early Purple *Guigne* (*s*).
+Elton (*s*).
+Eugenie, *Empress* (*s*).
+Florence (*s*).
+Hortense, *Reine* (*s*).
+Hovey (*s*).
Late Kentish.
Lutovka.
+Magnifique, *Belle* (*s*).
+Mayduke (*s*).
+Montmorency Large.
+Montmorency Ordinaire.
Morello, *English.*
+Napoleon (*s*).
+Olivet (*s*).
+Philippe, *Louis* (*s*).
+Plumstone Morello (*s*).
Richmond.
+Tartarian, *Black.*
+Windsor.
+Wood, *Governor.*

Cranberries.

Currants.

Albert, *Prince.*
+Cherry.
+Fay *Prolific* (*s*).
Holland, *Long Bunch.*
+London *Red* (*s*).
Red Dutch.
+Red Grape.
+Versaillaise.
Victoria.
White Dutch.
White Grape.

Black currants.

Champion (*s*).
English (*s*).
Naples (*s*).
+Wales, *Prince of* (*s*).

Grapes.

Agawam.
+Barry.
Brighton.
Champion.
Clinton.
Concord.
Cottage.
+Diana.
Lindley.
+Martha.
Moore *Early.*
+Salem.
Vergennes.
Victor, *Early.*
+Wilder.
Winchell (*Green Mountain*).
Worden.

Pears.

+Andrews.
+Angouleme, *Duchess de* (*s*).
+Anjou (*s*).
+Bartlett (*s*).
+Bosc (*s*).
+Boussock (*s*).
+Brandywine (*s*).
+Buffum.
+Clairgeau (*s*).
+Clapp *Favorite* (*s*).
+Columbia (*s*).
+Dana Hovey (*s*).
+Diel.
+Dix.
+Elizabeth, *Manning.*
+Flemish *Beauty.*
+Fulton.
+Giffard (*s*).
+Goodale.
+Howell (*s*).

FRUITS—continued.

Pears—Continued.

+Julienne (*s*).
+Lawrence (*s*).
+Louise *Bonne de Jersey.*
+Lucrative (*s*).
+McLaughlin.
+Madeleine (*s*).
+Malines, *Josephine de* (*s*).
+Onondaga (*s*).
+Osband *Summer* (*s*).
+Pound.
+Rostiezer (*s*).
+Seckel (*s*).
+Sheldon (*s*).
+Souvenir *du Congress* (*s*).
+Sterling.
+Summer Doyenne (*s*).
+Tyson.

Plums.

+Arctic, *Moore.*
Aubert, *Yellow.*
+Bavay *Green Gage.*
De Soto.
+Diamond, *Black* (*s*).
Downing, *Charles.*
+Drap d'Or (*s*).
+Duane *Purple* (*s*).
+Englebert (*s*).
Forest *Garden.*
+German Prune (*s*).
+Golden Drop, *Coe* (*s*).
+Grand Duke (*s*).
Green Gage.
+Hudson *River Purple Egg* (*s*).
+Hulings *Superb* (*s*).
+Imperial Gage (*s*).
+Jefferson (*s*).
+Kingston (*s*).
+Lawrence *Favorite* (*s*).
Lombard.
+McLaughlin.
Moldavka.
+Monroe *Egg* (*s*).
+Orleans (*s*).
+Ottoman (*s*).
+Pond (*Hungarian Prune*).
+Purple Gage (*s*).
+Quackenboss (*s*).
Richland.
Rollingstone.
+Shropshire (*s*).
+Smith Orleans (*s*).
+Transparent *Gage* (*s*).
+Wales, *Prince of* (*s*).
+Wangenheim (*s*).
+Washington (*s*).
Weaver.
Wolf.
Wyant.
Yellow Egg.

Quinces.

Orange (*Apple*) (*s*).

Strawberries.

Bubach *No. 5.*
Crescent.
Cumberland.
Downing, *Charles.*
Eureka (*s*).
Haverland.
Jessie.
Michel *Early* (*s*).
Miner.
Princess.
Sharpless.
Warfield.
Wilson.

MISCELLANEOUS.

Flax (*s*).
Hops.
Maple sugar.
Sorghum (*s*).
Sugar beet.
Sweet corn.
White potatoes.

(*b*) The Arid Transition Faunal Area.

The western or arid division of the Transition zone comprises the western part of the Dakotas, northern Montana east of the Rocky Mountains, southern Assiniboia, small areas in southern Manitoba and Alberta, the higher parts of the Great Basin and the plateau region generally (except the Boreal Mountains), the eastern base of the Cascade-Sierra system, and local areas still farther west, in Oregon and California, where it merges into the humid Pacific Coast division.

In the western arid Transition area the true sage brush (*Artemisia tridentata*) is the prevailing type of vegetation, although extensive tracts are covered with noble forests of the yellow or bull pine (*Pinus ponderosa*) and subspecies.[1] The sage hen and sharp-tailed grouse, green-tailed towhee, white-tailed jackrabbit (*Lepus campestris*), pallid voles (subgenus *Lagurus*), and certain ground squirrels are characteristic species. In the northern parts of the Great Basin (northern and eastern Washington, northeastern Oregon, and northwestern Idaho) the large Columbia or Lewis and Clark ground squirrel (*Spermophilus columbianus*) is common in the Transition zone, whence it ranges northward into the Boreal. East of the Rocky Mountains, on the northern plains (in North Dakota, northern Montana, and parts of Assiniboia and Manitoba), it is replaced by a very different species (*S. richardsoni*), which resembles a small prairie dog (*Cynomys*) so closely that it is often mistaken for that animal.

Crops of the Arid Transition Faunal Area.

[Lists very incomplete.]

CEREALS.

Wheat.

Ladoga.
Red Fife.
Saskatchewan Fife (*?*).
Scotch Fife.

Oats.

American Banner.
Black Tartarian.
Lincoln.
Welcome.
White Russian.

Corn.

Angel of Midnight (*?*).
Canadian Eight-Row Yellow Flint (*?*).
King Philip (*?*).
Longfellow (*?*).
Squaw.
Stowell Evergreen (*?*).

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[1] Among the distinctive humbler plants which recur throughout the pine belt from Arizona to Oregon two small shrubs, *Berberis repens* and *Ceanothus fendleri*, are conspicuous. *Gilia aggregata*, a small plant with handsome red flowers, is also common in this belt.

CEREALS—continued.

Barley.

Rye.

Buckwheat.

FRUITS.[1]

Apples.

Alexander.
Baldwin.
Dutch Mignonne.
Dyer (*Pomme Royal*).
Early Harvest.
Early Strawberry.
Esopus *Spitzenburg.*
Fameuse.
Golden Russet.
Golden Sweet.
Gravenstein.
Hightop *Sweet.*
Hubbardston.
Jefferis.
Jonathan.
Keswick.
Longfield.
Lowell.
Maiden Blush.
Monmouth.
Mother.
Newtown Spitzenburg.
Northern Spy.
Oldenburg, *Duchess of.*
Pewaukee.
Porter.
Primate.
Rambo.
Red Astrachan.
Rhode Island *Greening.*
Roman Stem.
Rome Beauty.
Roxbury.
Sops of Wine.
Summer Pearmain.
Swaar.
Tetofski.
Tolman *Sweet.*
Tompkins King.
Twenty-Ounce.
Wagener.
Wealthy.
Westfield.
Williams *Favorite.*
Wine, *Hays.*
Winesap. (?)
Wolf *River.*
Yellow Newtown *Pippin.*
Yellow Transparent.

Cherries.

Archduke.
Choisy, *Belle de.*
Ostheimer *Weichsel.*

Grapes.

Wilder.
Worden.

Pears.

Angouleme, *Duchess de*
Anjou.
Bartlett.
Bosc.
Boussock.
Brandywine.
Clairgeau.
Clapp *Favorite.*
Columbia.
Easter *Beurre.*
Flemish *Beauty.*
Lawrence.
Lucrative.
Onondaga.
Osband *Summer.*
Seckel.
Tyson.
Winter Nelis.

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[1] At the present time the culture of fruits enumerated under the Arid Transition faunal area is confined largely to western Montana, Idaho, eastern Washington, eastern Oregon, and parts of Utah.

FRUITS—continued.

Plums.

De Soto.
Forest *Garden.*

Strawberries.

Bubach *No. 5.*
Captain Jack.
Jessie.

MISCELLANEOUS.

White potatoes.

Flax.

Sugar beet.

(*c*) THE PACIFIC COAST TRANSITION FAUNAL AREA.

The humid Pacific Coast division of the Transition zone comprises the western parts of Washington and Oregon between the coast mountains and the Cascade Range, parts of northern California, and most of the coast region of California from near Cape Mendocino southward to the Santa Barbara Mountains. To the south and east it passes into the Arid Transition, and in places into the Upper Sonoran.

In the *Pacific Transition area* unusual conditions prevail. The region as a whole is one of great humidity, and in places on the northwest coast the annual rainfall reaches 100 inches. The northern and more humid part is covered by a magnificent coniferous forest, carpeted with moss and ferns, and often choked with undergrowth. The prevailing trees are Douglas fir, Pacific cedar, Western hemlock, and Sitka spruce, whose majestic trunks attain an average height of more than 200 feet. There are also many broad-leaf maples, tree alders, madroñas and Western dogwoods, and numerous kinds of shrubs,[1] a goodly proportion of which aspire to the size of small trees. Among the birds which inhabit these forests are the dark Pacific Coast forms of the great-horned, spotted, screech, and pigmy owls, the sooty grouse and handsome Oregon ruffed grouse, Steller's jay, the chestnut-backed chickadee, and the Pacific winter wren. Among the mammals are the Columbia black-tail deer, Western raccoon, Oregon spotted skunk, Douglas red squirrel, Townsend's chipmunk, peculiar species of pocket gophers and voles, the curious Gibb's mole, and the remarkable tailless sewellel (*Aplodontia rufa*).

In the Puget Sound region and most of the cultivated parts of western Washington the annual rainfall is 50 to 60 inches; in western Oregon it is still less, decreasing in the Willamette, Umpqua, and Rogue River valleys from about 50 to less than 30 inches.[2] In the last-mentioned valleys the summer rainfall (May to September) is less than 5 inches, while in western Washington (not including the coast or mountains) it varies from 5 to 10 inches. The region as a whole is one of relatively uniform temperature, the wide seasonal differences usual in other parts of the Transition zone being unknown. The temperature of the summer season, the hottest part of the year, is phenomenally low for the latitude, enabling northern or Boreal types to push south as far as latitude 35°. On the other hand, the summer season is so prolonged (from the standpoint of temperature) that the total quantity of heat for the entire season is phenomenally high for the latitude, enabling southern or Austral species to push north as far as Puget Sound, where the total quantity of heat is even greater than at Philadelphia, Pittsburg, Cleveland, and Omaha, although Puget Sound is 500 miles north of the latitude of these places. Even at Cape Flattery—the extreme northwestern point of the United States—which is exposed throughout the year to the cold coast fogs, the total quantity of heat is 500° F. greater than at Eastport, Me., although the latter is the more southern locality and has the higher mean summer temperature. The low summer temperature along the Pacific Coast permits northern species to come far south, while the high sum total of heat enables southern species to push northward as far as Puget Sound. Such an extensive overlapping of Boreal and Austral faunas does not occur elsewhere in North America, and for the evident reason that no area approaching it in extent has so equable a temperature.

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[1] Among the small shrubs perhaps none are more characteristic and widespread than the salal (*Gaultheria shallon*), thimble berry (*Rubus nootkanus*), salmon berry (*Rubus spectabilis*), Oregon grape (*Berberis nervosa*), and in wet places the devil's club (*Echinopanax horridum*).

[2] Rainfall of the Pacific Slope and the Western States and Territories, by Gen. A. W. Greely, Chief Signal Officer, and Lieut. W. A. Glassford, assistant, 1888.

In most parts of the United States it is easy to distinguish the boundaries between the Transition and Upper Austral zones, but in the Pacific Transition area these distinctions are nearly obliterated, a large proportion of the species ranging in common over both belts.

To the southward, particularly away from the coast, where the Pacific Transition area receives less moisture and more summer heat and the seasonal changes of temperature are greater, the faunal relations become more and more complex. The decrease in humidity allows Arid Transition species to creep in, while the increase in total quantity of heat brings with it a marked increase in the number of Upper Sonoran species, so that types ordinarily characteristic of the humid Pacific Transition, the Arid Transition, and the Upper Sonoran occur together.[1] The total quantity of heat in most parts of the Willamette and Rogue River valleys is about 2,000° F. more than in the Puget Sound region, and is as great as on the adjacent plains of the Columbia and slightly greater than at St. Louis, Mo., and Washington, D. C.

These warmer and less humid parts of the Pacific Transition area, as the Willamette, Umpqua, and Rogue River valleys in Oregon, and numerous small areas in California, are adapted to a much wider range of agricultural products than normal parts of the same zone, and are conspicuous for the large number of Upper Austral fruits which may be cultivated with success. In passing southward from the Puget Sound region this increase in Austral varieties is very marked, but it is poorly indicated in the following list:

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[1] Hood River, at the north base of the Cascade Range in Oregon, is situated in the belt of overlapping, where the humid Pacific Transition of the gorge of the Columbia merges into the arid Upper Sonoran of the adjacent Great Basin.

Crops of the Pacific Coast Transition Faunal Area.

CEREALS.

Wheat.

Red Fife (*2*).

Oats.

American Banner (*2*).
Black Tartarian (*2*).
Lincoln (*2*).
Welcome.
White Russian.

Corn.

King Philip.
Pride of the North (*2*).
Stowell Evergreen (*2*).

Buckwheat.

FRUITS.

Apples.

Baldwin.
Ben Davis (*s*).
Blue Pearmain.
Early Harvest (*s*).
Esopus.
Fall Pippin (*s*).
Gravenstein.
Jonathan (*s*).
Keswick.
Maiden Blush.
Monmouth.
Northern Spy.
Oldenburg, *Duchess of.*
Rambo (*s*).
Red Astrachan.
Red June (*s*).
Rhode Island *Greening.*
Sops of Wine.
Swaar.
Tompkins King.
Wagener.
Wealthy.
Winesap (*s*).
Yellow Bellflower (*s*).
Yellow Newtown *Pippin* (*s*).
Yellow Transparent.

Cherries.

Advance, *California.*
Bing.
Centennial.
Coe *Transparent.*
Elton.
Lewelling (*Black Republican*).
Napoleon (*Royal Ann*).
Richmond (*Kentish*).
Rockport.
Spanish, *Yellow.*
Tartarian, *Black.*
Windsor.
Wood, *Governor.*

Cranberries.

Currants.

Black Naples.
Cherry.
Fay *Prolific.*
Red Dutch.
Victoria.
White Grape.

FRUITS—continued.

Gooseberries.

Grapes.

Concord.
Isabella.
Moore *Early.*

Peaches.

Hale.

Pears.

Bartlett.
Bosc (*s*).
Boussock.
Clairgeau (*s*).
Clapp *Favorite.*
Flemish *Beauty.*
Seckel (*s*).
Tyson (*s*).
Winter Nelis (*s*).

Plums (including prunes).

Agen (*French*, *Petite*, etc.) (*s*).
Columbia.
Dosch.
German *Prune.*
Golden Drop, *Coe* (*s*).
Golden *Prune* (*s*).
Italian (*Fellenberg*) (*s*).
Pond (*Hungarian Prune*).
Silver *Prune* (*s*).
Tragedy (*s*).
Yellow Egg.

Strawberries.

Bubach, *No. 5.*
Clark *Seedling.*[1]
Crescent.
Everbearing.
Jessie.
Monarch.
Perry.
Sharpless.
Vick.
Wilson *Albany.*

MISCELLANEOUS.

Alfalfa (*s*).
Hops.
Sugar beet (*s*).
Sweet corn.
White potatoes.

5. THE UPPER AUSTRAL ZONE.

The Upper Austral zone (colored yellowish on the map) may be divided into two large and important faunal areas—an eastern humid or *Carolinian area* and a western arid or *Upper Sonoran area*, which pass insensibly into one another in the neighborhood of the one hundredth meridian. They may be described separately.

(*a*) THE CAROLINIAN FAUNAL AREA.

The Carolinian faunal area (colored yellowish, spotted with red, on the map) occupies the larger part of the Middle States, except the mountains, covering southeastern South Dakota, eastern Nebraska, Kansas, and part of Oklahoma; nearly the whole of Iowa, Missouri, Illinois, Indiana, Ohio, Maryland, and Delaware; more than half of West Virginia, Kentucky, Tennessee, and New Jersey, and large areas in Alabama, Georgia, the Carolinas, Virginia, Pennsylvania,

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[1] Markedly successful at Hood River, Oregon, where the Pacific or humid division of the Transition zone merges into the arid Upper Sonoran.

New York, Michigan, and southern Ontario. On the Atlantic coast it reaches from near the mouth of Chesapeake Bay to southern Connecticut, and sends narrow arms up the valleys of the Connecticut and Hudson rivers. A little farther west another slender arm is sent northward, following the east shore of Lake Michigan nearly or quite to Grand Traverse Bay. These arms, like nearly all narrow northward prolongations of southern zones, do not carry the complete faunas and floras of the areas to which they belong, but lack certain species from the start and become more and more dilute to the northward till it is hard to say where they really end. Their northern boundaries, therefore, must be drawn arbitrarily or must be based on the presence or absence of particular species rather than the usual association of species.

Counting from the north, the Carolinian area is that in which the sassafras, tulip tree, hackberry, sycamore, sweet gum, rose magnolia, red bud, persimmon, and short-leaf pine first make their appearance, together with the opossum, gray fox, fox squirrel, cardinal bird, Carolina wren, tufted tit, gnatcatcher, summer tanager, and yellow-breasted chat. Chestnuts, hickory nuts, hazelnuts, and walnuts grow wild in abundance. The area is of very great agricultural importance.

Crops of the Carolinian Faunal Area.

Cereals do well in the Carolinian area, particularly wheat and corn. The sugar beet is an important crop in the northern parts, but fails to develop sufficient sugar for profitable culture in the southern parts. Fruits thrive almost everywhere, and in great variety, as shown by the following list:

CEREALS.

Wheat.

Clawson.
Fulcaster.
Fultz.
Mediterranean.
Turkey Red [Mississippi Valley].
Velvet Chaff.

Oats.

Lincoln (*2*).
Red Rust Proof.
Welcome.
White Russian (*2*).

Corn.

Bloody Butcher.
Golden Dent (*2*).
Hickory King (*2*).
King Philip (*3*).
Leaming.
St. Charles White [Mississippi Valley] (*2*).
Stowell Evergreen.
White Gourd Seed (*2*).

Barley.

Rye.

Buckwheat (*2*).

FRUITS.

Apples.

Arkansas (*Mammoth Black Twig*).
Bailey *Sweet.*
Baldwin (*n*).
Belmont.
Ben Davis.
Benoni.
Bentley.
Bonum.
Bough, *Sweet.*
Bradford *Best* (*Kentucky Red*).
Broadwell.
Buckingham.
Cannon *Pearmain.*
Champlain (*Nyack*).
Clayton.
Cornell *Fancy.*
Cullasaga.
Domine (*n*).
Dyer (*Pomme Royal*).
Early Cooper.
Early Harvest.
Early Joe.
Early Pennock.
Early Strawberry.
Edward *Early.*
Esopus (*n*).
Evening Party.
Ewalt.
Fallawater.
Fall Orange.
Fall Pippin.
Fall Wine.
Fanny.
Fink.
Fulton.
Gilpin.
Golden Russet (*n*).
Golden Sweet.
Green Cheese.
Green Newtown.
Grimes *Golden.*
Haas (*Fall Queen*).
Hewes *Crab.*
Hightop *Sweet* [Mississippi Valley].
Hoover.
Horse.
Hubbardston (*n*).
Jefferis.
Jersey Sweet.
Jonathan (*n*).
July (*Fourth of July*).
Keswick.
Kinnaird.
Lady.
Lady Sweet.
Lansingburg.
Late Strawberry.
Lawver (*Delaware Red Winter*).
Limber Twig.
Lowell.
McAfee.
McLellan.
Maiden Blush.
Mangum.
Margaret, *Early Red.*
Milam.
Missouri *Pippin.*
Melon, *Norton* (*n*).
Monmouth.
Moore Sweet.
Mother.
Newtown Spitzenburg.
Nickajack.
Northern Spy (*n*).
Ohio Nonpareil.
Oldenburg, *Duchess of.*
Ontario (*n*).
Ortley.
Otoe (*n*).
Perry Russet (*n*).
Porter.
Primate.
Pryor *Red.*
Ralls *Genet.*
Rambo.
Ramsdell *Sweet.*
Red Astrachan.
Red June.
Red Stripe.
Rhode Island *Greening* (*n*).
Romanite, *South.*
Roman Stem.
Rome Beauty.
Shockley.
Smith *Cider.*
Smokehouse.
Sops of Wine (*n*).
Stark (*n*).
Summer Pearmain.
Summer Queen.
Summer Rose.
Sutton (*n*).
Swaar (*n*).
Sweet Winesap.

FRUITS—continued.

Apples—Continued.

Tetofski.
Tompkins King (*n*).
Trenton Early.
Twenty-Ounce (*n*).
Vandevere.
Wagener (*n*).
Walbridge (*Edgar Red Streak*).
Westfield (*n*).
White Juneating.
White Pearmain.
White Pippin.
Willow Twig.
Wine, *Hays* (*n*).
Winesap.
Wythe.
Yellow Bellflower.
Yellow Newtown *Pippin* (*Albemarle*).
Yellow Transparent.
York Imperial.

Crabapples.

Hyslop.
Martha.
Transcendent.
Yellow Siberian.

Apricots.[1]

Alexander [Mississippi Valley].
Breda.
Budd [Mississippi Valley].
Early Golden.
Gibb [Mississippi Valley].
Harris.
Hemskirke.
Large Early.
Moorpark.
Peach.

Cherries.

Archduke (*n*)
Black Heart.
Carnation.
Choisy, *Belle de.*
Coe *Transparent* (*n*).
Downer (*n*).
Dyehouse.
Eagle, *Black.*
Early Purple *Guigne.*
Elton (*n*).
Eugenie, *Empress.*
Hortense, *Reine.*
Knight *Early.*
Late Kentish.
Magnifique, *Belle.*
Mayduke.
Morello, *English.*
Napoleon (*Royal Ann*).
Olivet.
Plumstone Morello.
Richmond (*Kentish*).
Rockport (*n*).
Spanish, *Yellow.*
Tartarian, *Black.*
Windsor (*n*).
Wood, *Governor.*

Cranberries.

[While cranberries are an important crop in parts of New Jersey and a few other States within the general boundaries of the Carolinian fauna, they grow only in cold bogs which have the proper temperature of the Transition or even Boreal zone.]

Grapes.

Agawam (*n*).
Barry (*n*).
Brighton.
Catawba.
Champion.
Clinton (*n*).
Concord.
Cynthiana (*s*).
Delaware.
Diamond (*n*).
Diana (*n*).
Duchess.

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[1] Of little account in the Eastern States, because of too early flowering, with consequent danger from frost.

FRUITS—continued.

Grapes—Continued.

Elvira (*s*).
Goethe (*s*).
Iona (*n*).
Isabella.
Ives.
Jefferson.
Lindley.
Missouri Reisling (*s*). ?
Moore *Early*.
Niagara.
Noah [South Mississippi Valley] (*s*).
Norton *Virginia* (*s*).
Pocklington (*n*).
Prentiss (*n*).
Salem.
Telegraph.
Ulster (*n*).
Worden (*n*).
Wyoming.

Peaches.

Alexander.
Beers *Smock*.
Bilyeu.
Chili, *Hills*.
Early Crawford.
Elberta.
Foster.
George IV.
Globe.
Golden Drop.
Grosse Mignonne.
Hale.
Heath *Cling*.
Hoover.
Kenrick *Heath*.
Large York.
Late Admirable.
Late Crawford.
Late Rareripe.
Morris White.
Mountain Rose.
Oldmixon Cling.
Oldmixon Free.
Red Cheek *Melocoton*.
Reeves *Favorite*.
Richmond.
Rivers.
Salway.
Smock.
Sneed.
Stevens *Rareripe*.
Strawberry.
Stump.
St. John, *Yellow*
Susquehanna.

Nectarines.

Boston.
Elruge.
Stanwick.

Pears.

Angouleme, *Duchess de*.
Anjou (*n*).
Bartlett (*n*).
Bloodgood.
Bosc (*n*).
Boussock (*n*).
Brandywine.
Buffum (*n*).
Chambers.
Clairgeau (*n*).
Clapp *Favorite* (*n*).
Columbia.
Comice, *Doyenne du* (*n*).
Diel.
Easter *Beurre*.
Garber.
Giffard.
Gray Doyenne (*n*).
Hosenschenk.
Howell.
Julienne.
Kieffer.
Kirtland (*n*).
Lawrence.
Louise *Bonne de Jersey*.
Lucrative (*n*).
Madeleine (*n*).
Malines, *Josephine de* (*n*).
Marguerite, *Petite* (*n*).
Mount Vernon (*n*).
Napoleon (*n*).
Onondaga (*n*).
Osband *Summer*.
Paradise *d'Automne* (*n*).

FRUITS—continued.

Pears—Continued.

Rostiezer.
Rutter.
Seckel.
Sheldon.
Summer Doyenne.
Superfin (*n*).
Tyson.
White Doyenne (*n*).
Winter Nelis.

Plums.

Abundance.
Agen (*French*, *Petite*, etc.) (*n*).
Archduke (*n*).
Bavay *Green Gage* (*n*).
Bleecker *Gage* (*n*).
Bradshaw (*n*).
Burbank.
Chabot.
Clinton.
Columbia (*n*).
Copper (*n*).
Damson.
Diamond, *Black* (*n*).
Drap d'Or (*n*).
Duane *Purple* (*n*).
Englebert (*n*).
German *Prune* (*n*).
Golden Drop, *Coe*.
Grand Duke (*n*).
Hand (*n*).
Hudson *River Purple Egg* (*n*).
Hulings *Superb* (*n*).
Imperial Gage (*n*).
Italian (*Fellenberg*) (*n*).
Jefferson.
Kerr (*Hattankio 2*).
Kingston (*n*).
Lawrence *Favorite* (*n*).
Lombard.
Miner.
Monroe *Egg* (*n*).
Newman.
Ogon.
Orleans (*n*).
Ottoman (*n*).
Peach (*n*).
Prince *Yellow*.
Purple Favorite (*n*).
Purple Gage (*n*).
Red Nagate.
Richland.
Robinson.
Saratoga (*n*).
Saunders (*n*).
Satsuma.
Shropshire.
Smith Orleans (*n*).
Transparent *Gage* (*n*).
Washington (*n*).
Wales, *Prince of* (*n*).
Wangenheim (*n*).
Wild Goose.
Willard.
Yellow Egg (*n*).

Quinces.

Champion.
Missouri *Mammoth*.
Meech.
Orange (*Apple*).
Rea.

Raspberries.

Strawberries.

Bubach *No. 5*.
Crescent.
Cumberland.
Downing, *Charles*.
Enhance.
Eureka.
Gandy.
Greenville.
Haverland.
Jersey *Queen*.
Jessie.
Michel *Early*.
Miner.
Parker Earle.
Sandoval.
Sharpless.
Warfield.
Wood, *Beder*.

NUTS.

Peanuts[1] (*h*).

MISCELLANEOUS.

Cowpeas.
Flax.
Hemp (*Cannabis sativa*).
Lima beans.
Sorghum.
Sugar beet.
Sweet potatoes (*h*).
Tobacco.
White potatoes.

(*b*) THE UPPER SONORAN FAUNAL AREA.

The Upper Sonoran faunal area (colored yellowish without spots on the map) of the Western States and Territories is the arid-land continuation of the Carolinian area of the more humid Eastern States. Beginning in the neighborhood of the one hundredth meridian, it covers most of the great plains in eastern Montana and Wyoming, southwestern South Dakota, western Nebraska, Kansas, Oklahoma, and Texas, and eastern Colorado and New Mexico. In Oregon and Washington it covers the plains of the Columbia and the Malheur and Harney plains; in California it encircles the Sacramento and San Joaquin valleys and forms a narrow belt along the eastern boundary of the Colorado and Mohave deserts; in Utah it covers the Salt Lake and Sevier deserts; in Idaho the Snake Plains, and in Nevada and Arizona irregular areas of suitable elevation, as will be seen by the map. Except in California, the most conspicuous vegetation of the Upper Sonoran areas is the true sagebrush (*Artemisia tridentata*), which, however, is equally abundant in the Transition zone. Several of the so-called 'greasewoods' (*Atriplex confertifolia*, *A. canescens*, *A. nuttalli*, *Tetradymia canescens*, *Sarcobatus vermiculatus*, and *Grayia spinosa*) are characteristic of suitable soils, and nut pines (piñon) and junipers occur here and there, mostly on the mountain slopes.

Among the characteristic birds and mammals are the burrowing owl, Brewer's sparrow, Nevada sage sparrow, Lazuli finch, sage thrasher, Nuttall's poor-will, Bullock's oriole, rough-winged swallow, five-toed kangaroo rats, pocket mice, grasshopper mice, sage chipmunk, sage cottontail, Idaho rabbit, black-tailed jack rabbit, and the Oregon, Utah, and Townsend's ground squirrels. Some parts of the Upper Sonoran in Oregon, Washington, and Idaho have so hot a climate that they might almost be considered Lower Sonoran. The localities referred to are Alvord Desert in southern Oregon, and certain parts of the valleys of the Snake and Columbia rivers, including the lower part of the canyon of the Des Chutes. While Alvord Desert is a direct continuation of the Sonoran deserts of Nevada, the areas along the Columbia and Snake rivers are completely isolated and widely removed, geographically, from the Lower Sonoran. Nevertheless, hot stretches in these valleys have been reached by the canyon wren (*Catherpes mexicanus conspersus*) and other southern species, and have been found adapted to the needs of a number of Lower Sonoran fruits. Thus, in the Snake River Valley at Lewiston, Idaho, and Almota, Wash., almonds, peanuts, sweet potatoes, and a variety of Lower Austral fruits do as well as several hundred miles farther south. This is well shown by the fact that the Sweetwater; Alexandria, *Muscat of;* Malaga; Peru, *Rose of;* Tokay, *Flame;* Zinfandel; and Thompson *Seedless* grapes thrive in this part of the valley.

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[1] Peanuts are not of much commercial importance in this zone, though grown on a small scale locally in Michigan, Nebraska, New Jersey, Delaware, and a few other States.

Crops of the Upper Sonoran Faunal Area.

The Upper Sonoran area, notwithstanding its aridity, is of considerable agricultural importance. Fruits and cereals succeed wherever water may be had for irrigation, and in the less arid parts wheat, corn, barley, and rye yield their heaviest returns. Kafir corn (a kind of millet) thrives without irrigation, particularly on the great plains, and alfalfa with irrigation matures several crops a year, though not so many as in the Lower Sonoran.

CEREALS.

Wheat.

Australian.
Fultz (*3*).
May wheats (*3*).
Mediterranean (*2*).
Red Fife (*2*).
Sonora.
Turkey Red (*2*).
Velvet Chaff (*3*).

Oats.

Lincoln (*2*).
Red Rust Proof (*2*).
Welcome (*2*).
White Russian (*2*).

Corn.

Hickory King (*3*).
King Philip (*2*).
Leaming (*2*).
Pride of the North (*3*).
Squaw (*3*).

Barley.

Rye.

FRUITS.

Apples.

Alameda, *Beauty of.*
Belmont.
Ben Davis.
Blue Pearmain.
Cook *Seedling.*
Dyer (*Pomme Royal*).
Early Harvest.
Early Pennock.
Early Strawberry.
Esopus *Spitzenburg.*
Fall Jenneting.
Fall Orange.
Fall Pippin.
Fall Wine.
Gloria Mundi.
Golden Russet.
Golden Sweet.
Grimes *Golden.*

FRUITS—continued.

Apples—Continued.

Haas (*Fall Queen*).
Hawthornden.
Hightop *Sweet.*
Holland *Pippin.*
Hubbardston.
Jersey Sweet.
Jonathan.
Keswick.
Lady Sweet.
Lawver (*Delaware Red Winter*)
Limber Twig.
Lowell.
Maiden Blush.
McAfee.
Marshall *Red* (*Red Bellflower*).
Missouri *Pippin.*
Monmouth *Pippin* (*Red Cheek Pippin*).
Mother.
Newtown Spitzenburg.
Nickajack.
Northern Spy.
Oldenburg, *Duchess of.*
Porter.
Primate.
Ralls *Genet.*
Rambo.
Red Astrachan.
Red Canada.
Red June.
Rhode Island *Greening.*
Roman Stem.
Rome Beauty.
Smith *Cider.*
Summer Pearmain.
Summer Queen.
Summer Rose.
Swaar.
Tetofski.
Tompkins King.
Twenty-Ounce.
Wagener.
Wealthy.
Westfield.
White Pearmain.
Wine, *Hays.*
Winesap.
Wolf *River.*
Yellow Bellflower.
Yellow Newtown *Pippin.*

Apricots.

Alexander.
Blenheim.
Breda.
Budd.
Eureka.
Gibbs.
Hemskirke.
Large Early.
Montgamet, *Alberge de.*
Montgamet Early.
Moore Early.
Moorpark.
Newcastle.
Peach.
Pringle.
Royal Golden, *Brier.*
St. Ambroise.
Vestal *Moorpark.*

Cherries.

Archduke.
Bing.
Centennial.
Choisy, *Belle de.*
Cleveland.
Early Purple *Guigne.*
Late Duke.
Lewelling (*Black Republican*).
Mayduke.
Montmorency Large.
Montmorency Ordinaire.
Morello, *English.*
Napoleon (*Royal Ann*).
Olivet.
Ostheimer, *Weichsel.*
Richmond (*Kentish*).
Rockport.
Spanish, *Yellow.*
Tartarian, *Black.*
Thompson *Seedling.*
Windsor.
Wood, *Governor.*

FRUITS—continued.

Grapes.

Agawam.
Alexandria, *Muscat of* (*h*).[1]
Black Ferrara.
Black Hamburgh.
Catawba.
Chasselas, Red.
Chasselas Rose.
Concord.
Delaware.
Elvira.
Emperor (*h*).
Isabella.
Ives.
Malaga (*h*).
Massasoit.
Mission.
Moore *Early*.
Norton *Virginia*.
Pierce (*Isabella Regia*).
Peru, *Rose of* (*h*).
Prince, *Black*.
Royal Muscatine (*h*).
Salem.
Sweetwater (*h*).
Thompson *Seedless* (*h*).
Tokay, *Flame* (*h*).
Victor, *Early*.
Worden.
Zinfandel (*h*).

Peaches.

Alexander.
Beers *Smock*.
Bilyeu.
Brandywine.
Chair *Choice*.
Early Crawford.
Early York.
Elberta.
Foster.
Garey.
Garfield.
Globe.
Golden Cling.
Garland, *Governor*.
Hale.
Heath *Cling*.
Late Crawford.
Lovell.
Malta.
McKevitt *Cling*.
Muir.
Newhall.
Nichols *Cling*.
Orange Cling.
Picquet *Late*.
Reeves *Favorite*
Rivers.
Runyon *Orange Cling*.
St. John, *Yellow*.
Salway.
Smock.
Strawberry.
Stump.
Susquehanna.
Tuskena (*Tuscany*).
Waterloo.
Wilkins.

Nectarines.

Hunt *Tawny*.
Red Roman.

Pears.

Angouleme, *Duchess de*.
Anjou.
Bartlett.
Bosc.
Boussock.
Brandywine.
Clairgeau.
Clapp *Favorite*.
Columbia.
Dana Hovey.
Diel.
Easter *Beurre*.
Flemish *Beauty*.
Glout Morceau.

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[1] As explained on page 21, varieties marked (*h*) succeed only in the hottest localities, as at Lewiston and Almota, in Snake River Valley. They are in reality not Upper Sonoran varieties at all, but belong to the Lower Sonoran area.

FRUITS—continued.

Pears—Continued.

Idaho [local in Idaho].
Lawrence.
Louise *Bonne de Jersey.*
Lucrative.
Margaret.
Onondaga.
Osband *Summer.*
Patrick Barry.
Seckel.
Vicar *of Winkfield.*
White Doyenne.
Winter Nelis.

Plums (*including prunes*).

Agen (*French*, *Petite*, etc.).
Bavay *Green Gage.*
Bradshaw.
Cherry.
Columbia.
Clyman.
German *Prune.*
Golden Drop, *Coe.*
Golden *Prune.*
Imperial *Gage.*
Italian.
Kanawha.
Lombard.
McLaughlin.
Peach.
Pond (*Hungarian Prune*).
Sergent, *Robe de.*
Shropshire.
Silver *Prune.*
Tragedy.
Washington.
Yellow Egg.

Quinces.

Champion.
Orange.
Portugal.

Raspberries.

Strawberries.

Bubach *No. 5.*
Captain Jack.
Clark *Seedling.*
Crawford.
Jessie.
Longfellow.
Monarch.
Parker Earle.
Sharpless.
Thompson *No. 7.*

NUTS.

European chestnuts.

Combale, *Marron.*
De Lyon, *Marron.*

European walnuts.

Chaberte.
Franquette.
Mayette.
Parisienne.
Prœparturiens.
Serotina.

Filberts and hazelnuts.

Du Chilly.
Lambert.
Piedmont.
Purple Leaf.
Red Aveline.

MISCELLANEOUS.

Alfalfa.
Cowpeas.
Kafir corn.
Hemp.
Lima beans.
Sorghum.
Sugar beet (*n*).
Sweet potatoes.
Tobacco.
White potatoes.

6. THE LOWER AUSTRAL ZONE.

The Lower Austral zone occupies the southern part of the United States, from Chesapeake Bay to the great interior valley of California. It is interrupted by the continental divide in eastern Arizona and western New Mexico, and is divided, according to conditions of humidity, into an eastern or *Austroriparian*, and a western or *Lower Sonoran*, area.

(*a*) THE LOWER SONORAN FAUNAL AREA.

The Lower Sonoran area begins with the arid region of Texas in the neighborhood of latitude 98°, and stretches westerly to the Rio Grande Valley, in which it sends an arm northwest to a point a little north of Albuquerque, N. Mex. Another arm reaches up the valley of the Pecos. West of the Rio Grande Valley in New Mexico the Lower Sonoran is interrupted by the continental divide. It begins again in eastern Arizona and sweeps broadly westward below the high plateau, covering southern and western Arizona, the deserts of southern Nevada and eastern California, and the San Joaquin and Sacramento valleys. Followed more in detail, the Lower Sonoran in western Arizona sends a narrow tortuous arm eastward in the Grand Canyon of the Colorado, which expands to cover the lower levels of the Painted Desert, and another arm northward, which enters the extreme southwestern corner of Utah, where it is restricted to the St. George or lower Santa Clara Valley, and is of much agricultural importance.[1] From western Arizona it spreads over southern Nevada, pushes northerly into Pahranagat Valley, sends an arm by way of Oasis and Sarcobatus valleys all the way to the sink of the Humboldt and Carson rivers, fills the whole of Death, Panamint, and Saline valleys and part of Owens Valley, and thence curving southwesterly follows the eastern base of the Sierra Nevada, Tehachapi, and Tejon mountains, and covers the whole of the Mohave and Colorado deserts and all the rest of southern California except the mountains. It sends an arm southward over most of the peninsula of Lower California, and another northward over the San Joaquin and Sacramento valleys.

The Lower Sonoran area comprises the most arid deserts of North America, and is characterized by a fauna and flora of extreme interest. Among the commoner plants are the creosote bush, mesquites, acacias, cactuses, yuccas, and agaves. Among the characteristic birds are the mockingbird, road runner, cactus wren, canyon wren, desert thrashers, hooded oriole, black-throated desert sparrow, Texas nighthawk, and Gambel's quail. Among the distinctive mammals are the four-toed kangaroo rats, Sonoran pocket mice, long-eared desert fox, and the big-eared and tiny white-haired bats. The region, wherever water may be had for irrigation, is of great agricultural importance, particularly for fruit.

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[1] Cotton, tobacco, raisin grapes, almonds, olives, figs, and other Lower Sonoran crops are raised successfully in the St. George Valley.

Crops of the Lower Sonoran Faunal Area.

Raisin and wine grapes, oranges, lemons, olives, prunes, peaches, apricots, English walnuts, and almonds are among the important products of the Lower Sonoran area, and the fig ripens several crops each year. Although too far south for the highest development of cereals, several varieties, as the Australian and Sonora wheats, the red rust-proof oats, and the white gourd seed corn, do well. Cotton, tobacco, pyrethrum, and the opium poppy thrive in certain localities, and alfalfa, cowpeas, and canaigre (a plant valuable for tanning) do better than in any other area.

CEREALS.

Barley (*2*).

Corn.

White Gourd Seed (*2*).

Oats.

Red Rust Proof (*2*).

Rye (*2*).

Wheat.

Australian.

Sonora.

FRUITS.

Avocado (*Aguacate*). (*h*)[1]

Apples.

Marshall *Red* (*Red Bellflower*).
Sexton *Golden*.
Skinner *Seedling* (*Santa Clara King*).
Yellow Bellflower.
Yellow Newtown *Pippin*.

Apricots.

Breda.
Hemskirke.
Hinds *Seedling*.
Montgamet, *Alberge de*.
Montgamet Early.
Moorpark.
Peach.
Roman.
Royal.
Royal Golden, *Brier*.
Sparks.
St. Ambroise.
Vestal *Moorpark*.

Cherries.

Early Purple *Guigne*.

Carob.

Cherimoyer. (*h*)[1]

Citron.

Dates. (*h*)[1]

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[1] There are several hot pockets in the Lower Sonoran in which tropical or arid tropical fruits may be grown with greater or less success. The best known of these is near Santa Barbara, Calif., where the following are said to flourish: Avocado (*Persea gratissima*), capullin (*Prunus capuli*), cherimoyer (*Anona cherimolia*), kai-apple (*Aberia caffra*), mango (*Mangifera indica*), Moreton Bay chestnut (*Castanospermum australe*), pepino (*Solanum muricatum*), Queensland nut (*Macadamia ternifolia*), rose apple (*Eugenia jambos*), sapodilla (*Achras sapota*), tree tomato (*Cyphomandra betacea*), and zapote blanco (*Casimiroa edulis*).

FRUITS—continued.

Figs.

Adriatic.
Brunswick.
Du Roi.
Genoa, *White.*
Gentile.
Ischia, *White.*
Marseillaise, *White.*
Mission, *Black.*
Monaco Bianco.
Smyrna.
San Pedro Black.
Turkey, *Brown.*

Granadilla.

Grapes.

Alexandria, *Muscat of.*
Black Hamburg.
Emperor.
Feher Szagos.
Gordo Blanco.
Herbemont.
Huasco.
Malaga.
Mission.
Muscat-Hamburg.
Peru, *Rose of.*
Prince, *Black.*
Sultana.
Sweetwater (*Fontainebleau*).
Thompson *Seedless.*
Tokay, *Flame.*
White Muscat.
Zinfandel.

Guavas.

Cattley (*Strawberry*).
Chinese (*Mexican*).

Japanese persimmons.

[Numerous varieties.]

Jujube.

Kumquat.

Lemons.

Eureka.
Genoa.
Sicily.
Villa Franca.

Limes.

Mexican.
Tahiti.

Loquat.

Mandarin oranges.

Satsuma.
Tangerine.

Mulberries.

Black Spanish.
Downing.
Persian.

Olives.

[Numerous varieties.]

Oranges.

Bahia (*Washington Navel*).
Hart Late (*Excelsior*).
Malta Blood.
Maltese Oval.
Mediterranean *Sweet.*
Paper Rind *St. Michael.*
Ruby Blood.
St. Michael.
Valencia *Late.*

FRUITS—continued.

Peaches.

Alexander.
Early Crawford (*n*).
Early York.
Elberta.
Foster (*n*).
Garland, *Governor*.
Hale.
Heath *Cling*.
Henrietta.
Late Crawford (*n*).
Lemon Cling.
Muir.
St. John, *Yellow*.
Strawberry.
Susquehanna.

Nectarines.

Boston.
Downton.
Early Newington.
Early Violet.
Elruge.
Hardwicke.

Pears.

Angoulême, *Duchess de*.
Bartlett.
Bosc.
Boussock.
Brandywine.
Clairgeau.
Easter *Beurre*.
Glout Morceau.
Howell (?).[1]
Lawrence.
Louise *Bonne de Jersey*.
Lucrative.
Patrick Barry.
Pound.
Seckel.
Superfin.
Tyson (?).[1]
White Doyenne.
Winter Nelis.

Pepino (Solanum muricatum).

Pineapple (?).[1]

Pomegranates.

Pomeloes.

[Several varieties]

Plums (including prunes).

Agen (*French, Petite, etc.*).
Caddo Chief.
Columbia.
El Paso.
German *Prune*.
Golden Drop, *Coe*.
Italian (*Fellenberg*).
Jefferson.
Peach.
Sergent, *Robe de*.
Simon (*Prunus simonii*).

Strawberries.

Australian *Crimson*.
Burt.
Longfellow.
Monarch.
Sharpless.

Tamarind.

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[1] The interrogation point (?) signifies that the variety or species so marked is included in the list upon information sufficiently positive to make such inclusion necessary, but lacking such full verification as would permit the listing without qualification.

NUTS.

Almonds.

Blowers.
Brier.
Drake.
Golden State.
Gray [southwest Utah].
Harriott.
IXL.
King *Soft Shell.*
Languedoc.
Lewelling.
McCoy.
Ne Plus Ultra.
Nonpareil (*Extra*).
Paper Shell.
Routier, *New.*
Soft Shell, *Routier.*
Supremo.
Tarragona.
Twin, *Routier.*

European walnuts.

Bijou.
Chaberte.
Cluster.
Ford.
Franquette.
Gant (*Bijou*).
Kaghazi.
Mayette.
Mesange (*Paper Shell*).
Mission (*Los Angeles*)
Parisienne.
Prœparturiens.
Santa Barbara.
Serotina.

Peanuts.

Pecans.

Pistachio nut.

MISCELLANEOUS.

Alfalfa.
Black wattle (Acacia decurrens).
Canaigre (Rumex hymenosepalus).
Castor-oil bean.
Cork oak (Quercus suber).
Cotton.
Cowpeas.
Flax (seed).
Hemp.
Mustard.
Opium poppy.
Pyrethrum.
Ramie.
Roselle (Hibiscus sabdariffa).
Sorghum.
Sugar cane.
Sweet potatoes.
Tagasaste (Cytisus).
Tobacco.

(*b*) THE AUSTRORIPARIAN FAUNAL AREA.

The *Austroriparian* area occupies the greater part of the South Atlantic and Gulf States. Beginning near the mouth of Chesapeake Bay it covers half or more than half of Virginia, North and South Carolina, Georgia, Florida, Alabama, the whole of Mississippi and Louisiana, eastern Texas, nearly all of Indian Territory, more than half of Arkansas, and parts of Oklahoma, southeastern Kansas, southern Missouri, southern Illinois, the extreme southwestern corner of Indiana, and the bottom lands of western Kentucky and Tennessee. The long leaf and loblolly pines, magnolia, and live oak are common on the uplands; the bald cypress, tupelo, and cane in the swamps. Here the mocking bird, painted bunting, prothonotary warbler, red-cockaded woodpecker, chuck-wills-widow, and the swallow-tail and Mississippi kites are characteristic birds, and the southern fox squirrel, cotton rat, rice-field rat, wood rat, and free-tailed bat are common mammals.

CROPS OF THE AUSTRORIPARIAN FAUNAL AREA.

This is the zone of the cotton plant, sugar cane, rice, pecan, and peanut, and of the scuppernong grape and oriental pears (Le Conte and Kieffer). The more important crops are mentioned in the following list:

CEREALS.

Barley (*2*).

Corn.

Golden Dent.
Hickory King.
Leaming (*2*).
Mosby Prolific.
St. Charles White (*2*) [Mississippi Valley].
Stowell Evergreen (*2*).
White Gourd Seed.

Oats.

Burt.
Red Rust Proof.

Rye (*2*).

Wheat.

Fultz (*2*).
May wheats [away from coast].
Mediterranean (*3*).

FRUITS.

Apples.

Bonum (*n*).
Bradford *Best* (*Kentucky Red*).
Bruce.
Buckingham.
Cannon *Pearmain.*
Carter Blue.
Champlain (*Nyack*) (*n*).
Clark Pearmain.
Cornell *Fancy* (*n*).
Cracking.
Cullasaga.
Disharoon.
Farrar (*Robinson Superb*).
Ferdinand.
Gilpin (*n*).
Green Cheese.
Hall.
Hockett.
Hoover (*n*).
Horn.
Horse.
Jennings.
Julian.
July (*Fourth of July*) (*n*).
Junaluskee.
Limber Twig (*n*).
McAfee (*n*).
Mangum.
Manomet.
Mason Stranger.
Mattamuskeet.
Maverack.
Nansemond.
Nickajack (*n*).
Oconee.
Oldenburg, *Duchess of.*
Ralls *Genet.*
Red Astrachan.
Red June.
Romanite, *South.*
Shockley.
Stephenson.
Switzer [Mississippi Valley].
Taunton.
Watson.
Waugh *Crab.*
White Juneating.
Willow Twig.
Winesap (*n*).
Yates.
Yellow June.
Yellow Transparent.
Yopp.
York Imperial (*n*).

FRUITS—continued.

Apricots.[1]

Breda.
Early Golden.
Hemskirke.
Moorpark.
Musch.
Orange.
Royal.
St. Ambroise.
Turkey.

Cherries.

Archduke (*n*).
Black Heart (*n*).
Choisy, *Belle de* (*n*).
Early Purple *Guigne* (*n*).
Late Duke (*n*).
Magnifique, *Belle* (*n*).
Mayduke (*n*).
Morello, *English* (*n*).
Richmond (*Kentish*) (*n*).

Chinese quince.

Dewberry.

Lucretia.

Figs.

Brunswick.
Green Ischia.
Turkey, *Brown*.

Grapes.[2]

Berckmans.
Brighton (*n*).
Brilliant [Mississippi Valley].
Catawba.
Cynthiana.
Delaware (*n*).
Diamond, *Moore* (*n*).
Elvira.
Flowers.
Goethe (*n*).
Herbemont.
Jefferson (*n*).
Lenoir.
Lindley (*n*).
Missouri Reisling [Mississippi Valley].
Moore *Early* (*n*).
Niagara (*n*).
Norton *Virginia*.
Salem (*n*).
Scuppernong.
Tenderpulp.
Thomas.
Triumph.
Wylie, *Peter*.

Japanese persimmons.

Costata.
Hachiya.
Okame.
Yemon.

Mulberries.

Downing.
Hicks.
Stubbs.

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[1] Apricots are too often injured by late spring frosts to be a profitable crop in the Austroriparian.

[2] Varieties followed by the letter (*n*) belong to the Carolinian area, but thrive also along the upper edge of the Austroriparian.

FRUITS—continued.

Peaches.

Alexander (*n*).
Amelia.
Austin.
Blood Cling.
Blood Free.
Cabler *Indian.*
Chinese *Cling.*
Columbia.
Early Crawford (*n*).
Early York (*n*).
Elberta.
Hale (*n*).
Heath *Cling* (*n*).
Hoover.
Kerr, *Jessie.*
Late Crawford.
Lee, *General.*
Lemon Cling.
Mountain Rose (*n*).
Oldmixon Cling (*n*).
Pallas.
Picquet *Late.*
Sneed.
St. John, *Yellow.*
Thurber.
Tillotson.

Pears.

Angoulême, *Duchess de* (*n*).
Garber.
Julienne (*n*).
Kieffer.
Lawrence (*n*).
Le Conte.
Magnolia.
Rostiezer (*n*).
Seckel (*n*).
Tyson (*n*).

Plums.

Abundance (*Botan*).
Berckmans.
Burbank.
Caddo Chief [western].
Caradeuc, *De.*
Chabot.
Cumberland.
El Paso [western].
Georgeson (*Hattankio*).
Golden Beauty.
Kerr (*Hattankio 2*).
Indian Chief.
Lone Star.
Marianna.
Miner.
Newman.
Red Nagate.
Satsuma.
Transparent, *Yellow.*
Weaver.
Wild Goose.

Pomegranates.

Strawberries.

Bubach *No. 5* (*n*).
Cloud [Mississippi Valley].
Crescent.
Gandy (*n*).
Hoffman.
Michel *Early.*
Parker Earle.
Thompson, *Lady.*
Warfield [Mississippi Valley].

NUTS.

Almonds.[1]

English walnuts.

Pecans.

Peanuts.

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[1] Almonds are grown in the Austroriparian area, but are not a commercial success.

MISCELLANEOUS.

Castor bean.
China grass.
Cotton.
Cowpeas.
Jute.
Lima beans.
Rice.
Sorghum.
Sugar cane.
Sweet potatoes.
Tea.[1]
Tobacco.
Turpentine.

(*c*) SEMITROPICAL OR GULF STRIP.

The Gulf strip, or southern part of the Austroriparian area (colored orange on the map), reaches from Texas to southern Florida, covers a narrow strip in southern Georgia, and probably follows the coastal lowlands northward into South Carolina, though not so indicated on the map. It has a semitropical climate and is the home of a number of plants and animals not found farther north, among which are the cabbage palmetto, Cuban pine, ground dove, white-tailed kite, Florida barred and screech owls, Chapman's nighthawk, the Florida and boat-tailed grackles, and several small mammals.

CROPS OF THE SEMITROPICAL OR GULF STRIP.

The Gulf strip, though small in area, is of very great importance from the standpoint of agriculture and horticulture. It is the belt in which rice, sugar cane, and the much-prized Sea Island cotton are produced in greatest quantity and value; and, as a fruit belt, has no competitor except the Lower Sonoran areas of California and Arizona. Bitter oranges, loquats, granadillas, figs, Japanese persimmons, pecan nuts, and numerous varieties of peaches and grapes thrive here, and the citrus fruits (oranges, mandarins, lemons, limes, and shaddocks) are grown successfully in the warmer parts, particularly in peninsular Florida, but in the northern parts have suffered severely from frosts. The more important agricultural products are mentioned in the following list:

CITRUS FRUITS.

Bergamot oranges (*P*)[2].

Bitter oranges.

Lemons (*P*).

Belair.
Eureka.
Genoa.
Sicily.
Villa Franca.

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[1] Tea is grown successfully at Summerville, near Charleston, S. C., and would doubtless thrive in other parts of the Austroriparian belt; but the cost of picking the leaves is so great as to discourage its general cultivation.

[2] The letter (*P*) indicates that the fruit after which it is placed is cultivated successfully in peninsular Florida only, except in a few cases where it thrives also in the Mississippi delta below New Orleans.

CITRUS FRUITS—continued.

Mandarins.

Cleopatra (*P*).
Dancy *Tangerine* (*P*).
King (*P*).
Satsuma.
Tangerona (*P*).

Oranges (*P*).

Bahia (*Washington Navel*).
Beach *No. 5.*
Bessie.
Boone *Early.*
Buttercourt.
Centennial.
Circassian.
Colmar.
Cunningham.
Drake *Star.*
Dulcissima.
Du Roi.
Foster.
Hart *Late* (*Excelsior*).
Higley *Late.*
Imperial *Blood.*
Jaffa.
Jaffa Blood.
Lamb Summer.
Magnum Bonum.
Maltese Oval.
Mediterranean *Sweet.*
Nonpareil.
Oblong, *Early.*
Old Vini.
Parson *Brown.*
Pineapple.
St. Michael.
St. Michael Blood.
Star Calyx.
Thorpe *Trophy.*
Valencia *Late.*
Vinous, *Madame.*

Pomeloes (*P*).

Aurantium.
Blood.
Forbidden Fruit.
Hart.
Josselyn.
Mammoth.
Seedless.
Triumph.
Walter.

OTHER FRUITS.

Apples.

Jennings.
Red Astrachan.

Chinese quince.

Dewberry.

Lucretia.

Figs.

Adriatic, *White.*
Celestial.
Magnolia.
Marseillaise, *White.*

Granadillas.

Grapes.

Elvira.
Flowers.
Herbemont.
Scuppernong.
Tenderpulp.
Thomas.
Wylie, *Peter.*

OTHER FRUITS—continued.

Guavas (*P.*).

Cattley (*Strawberry*).
Chinese (*Mexican*).

Japanese persimmons.

Costata.
Hachiya.
Hiyakume.
Kurokuma.
Okame.
Tane Nashi.
Tsuru.
Yedo-ichi.
Yemon.
Zengi.

Kumquats (*P.*).

Loquats.

Peaches.

Angel.
Bidwell Early (*P.*).
Bidwell Late (*P.*).
Cabler Indian.
Climax.
Countess.
Early China (*P.*).
Ferdinand.
Florida Crawford.
Gibbon.
Honey.
Imperial.
Maggie *Burt*.
Onderdonk.
Pallas.
Peento (*P.*).
Waldo.

Pears.

Garber.
Kieffer.
Le Conte.
Magnolia.

Plums.

Kelsey.
Satsuma.
Wild Goose.

Pomegranates.

Strawberries.

Hoffman.
Michel *Early*.
Neunan.
Thompson, *Lady*.

NUTS.

Peanuts.

Pecans.

MISCELLANEOUS.

China grass [for fiber].
Cotton.
Jute.
Rice.
Sea Island cotton.
Sorghum.
Sugar cane.
Sweet potatoes.
Tobacco.

7. THE TROPICAL REGION.

The Tropical region within the United States is of small extent and is restricted to three widely separated localities—southern Florida, extreme southeast Texas (along the lower Rio Grande and Gulf coast), and the valley of the lower Colorado River in Arizona and California. The Florida area is genuine humid tropical; the Texas and Arizona-California areas are dilute arid tropical.

Among the tropical trees that grow in southern Florida are the royal palm, Jamaica dogwood, manchineel, mahogany, and mangrove; and among the birds are the caracara eagle, white-crowned pigeon, zenaida dove, quail doves, a Bahama vireo, and the Bahama honey creeper. The absence of characteristic tropical mammals and the relatively small number of tropical birds in Florida is due to the lack of land connection with other tropical areas; while the presence of the jaguar, ocelot, and other tropical cats, the armadillo, and a considerable number of tropical birds in southeastern Texas is the direct result of the continuous extension of the Tamaulipan arid tropical fauna from Mexico into Texas. The extension of the arid tropical along the lower Colorado and Gila rivers is over a desert region of such excessive aridity that only desert mammals and birds can live there. The flora has not been sufficiently studied, but is characterized by giant cactuses, desert acacias, palo verdes, and the Washington or fan-leaf palm.

Crops of the Tropical Region.

With irrigation the arid tropical areas are found to be as productive as the humid tropical, but they have been cultivated so short a time that their capabilities can only be inferred from the circumstance that bananas, citrons, dates, guavas, lemons, loquats, oranges, and Mexican limes do well in the Arizona-California arm. No information is at hand relating to the Texan or Tamaulipan arm.

Tropical Florida, with its handsome cocoanut palms and extensive banana fields, has been longer under cultivation, but its full capacity is still unknown, and the following list must be regarded as far from complete:

Crops of Tropical Florida.

CITRUS FRUITS.

Bergamot Orange (*Citrus bergamium*).
Citrons.
Lemons.
Limes.
Mandarins.
Oranges.
Pomeloes.

OTHER FRUITS.

Avocado (*Aguacate*).
Amatungula (*Carissa arduina*).
Banana.
Barbados gooseberry (*Pereskia aculeata*).
Caraunda, Christ thorn (*Carissa carandas*).
Cape gooseberry (*Physalis peruviana*).
Cashew nut.
Carob or St. John's bread (*Ceratonia siliqua*).
Cherimoyer.
Cocoanut.
Custard apple (*Anona reticulata*).
Date.
Downy myrtle (*Rhodomyrtus tomentosa*).
Egg fruit.

OTHER FRUITS—continued.

Ginep or Spanish lime.
Granadilla.
Guava.
Hog plum (Ximenia).
Kumquat.
Loquat.
Mammee apple.
Mammee sapota.
Mango.
Melon papaw (Carica papaya).
Monstera deliciosa.
Otaheite gooseberry (Phyllanthus distichus).
Pepino (Solanum muricatum).
Pineapple.
Pond apple (Anona glabra).
Rose apple (Eugenia jambos).
Sapodilla (Achras sapota).
Soursop (Anona muricata).
Southern dewberry (Rubus trivialis).
Strawberry tomato (Physalis alkekengi).
Sugar apple (Anona squamosa).
Surinam cherry (Eugenia uniflora).
Tamarind.

MISCELLANEOUS. [1]

Camphor.
Coffee.
Ramie.
Sisal hemp.
Tobacco.

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[1] Eggplants, tomatoes, beans, and some other garden vegetables are important crops in tropical Florida, but as the varieties of these have not yet been arranged by zones they can not be given here.

PART III.

LAWS OF TEMPERATURE CONTROL OF THE GEOGRAPHIC DISTRIBUTION OF ANIMALS AND PLANTS.[1]

Apart from obvious mechanical barriers, such as oceans, temperature is the most important single factor in fixing the limits beyond which particular species of animals and plants can not go. Investigations conducted by the Biological Survey have shown that *the northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction*,[2] and that *the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year.*[3]

ZONE TEMPERATURES.

THE BOREAL REGION.

Arctic, Hudsonian, and Canadian zones.—The distinctive temperatures of the three Boreal zones (Arctic, Hudsonian, and Canadian) are not positively known, but the southern limit of the Boreal as a whole is marked by the isotherm of 18° C. (64.4° F.) for the six hottest consecutive weeks of summer. It seems probable, from the few data available, that the limiting temperatures of the southern boundaries of the Hudsonian and Arctic zones are, respectively, 14° C. (57.2° F.) and 10° C. (50° F.) for the same period.

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[1] Abridged from a paper by the author entitled 'Laws of temperature control of the geographic distribution of terrestrial animals and plants,' National Geographic Magazine, Vol. VI, pp. 229–238, 3 colored maps, December, 1894.

[2] In computing the sum of the positive or effective temperatures a minimum temperature of 6° C. (43° F.) has been assumed as marking the inception of the period of physiological activity in plants and of reproductive activity in animals. The effective temperatures or degrees of normal mean daily heat in excess of this minimum have been added together for each station, beginning when the normal mean daily temperature rises higher than 6° C. in spring and continuing until it falls to the same point at the end of the season. The sums thus obtained were platted on a large scale map of the United States and connected by isotherms, which were found to conform in the most gratifying manner with the northern boundaries of the several life zones.

[3] The exact length of this period has not been determined. It must be short enough to fall within the hottest part of the summer in high northern latitudes, and probably increases in length from the north southward. For experiment, the mean normal temperature of the six hottest consecutive weeks was arbitrarily chosen and platted on a large scale map. Isotherms were then drawn, which conformed so closely with the southern boundaries of the Boreal, Transition, and Upper Austral zones that the matter was not carried further.

THE AUSTRAL REGION.

Transition zone species require a total quantity of heat of at least 5,500° C. (10,000° F.), but can not endure a summer temperature the mean of which for the six hottest consecutive weeks exceeds 22° C. (71.6° F.). The northern boundary of the Transition zone, therefore, is marked by the isotherm showing a sum of normal positive temperatures of 5,500° C. (10,000° F.), while its southern boundary is coincident with the isotherm of 22° C. (71.6° F.) for the six hottest consecutive weeks.

Upper Austral species require a total quantity of heat of at least 6,400° C. (11,500° F.), but apparently can not endure a summer temperature the mean of which for the six hottest consecutive weeks exceeds 26° C. (78.8° F.). The northern boundary of the Upper Austral zone, therefore, is marked by the isotherm showing a sum of normal positive temperatures of 6,400° C. (11,500° F.), while its southern boundary agrees very closely with the isotherm of 26° C. (78.8° F.) for the six hottest weeks.

Lower Austral species require a total quantity of heat of at least 10,000° C. (18,000° F.). The northern boundary of the Lower Austral zone, therefore, is marked by the isotherm showing a sum of normal positive temperatures of 10,000° C. (18,000° F.).

THE TROPICAL REGION.

Tropical species require a total quantity of heat of at least 14,400° C. (26,000° F.); and since the tropical life region is a broad equatorial belt, it is probable that both its northern and southern boundaries are marked by the isotherm showing a sum of normal positive temperatures of 14,000° C. (26,000° F.).

Governing temperatures of the zones.

Regions.	Zones.	Governing temperatures.			
		Northern limit.		Southern limit.	
		Sum of normal mean daily temperatures above 6° C. (43° F.).		Normal mean temperature of six hottest consecutive weeks.	
		°C.	°F.	°C.	°F.
Boreal	Arctic			[1] 10	[1] 50
	Hudsonian			[1] 14	[1] 57.2
	Canadian			18	64.4
Austral	Transition	5,500	[2] 10,000	22	71.6
	Upper Austral	6,400	11,500	26	78.8
	Lower Austral	10,000	18,000		
Tropical		14,500	26,000		

[1] Estimated from insufficient data.

[2] The Fahrenheit equivalents of centigrade sum temperatures are stated in round numbers to avoid small figures of equivocal value.

PART IV.

CROP TABLES.

The accompanying tables are arranged to show, under the head of particular crops (as cereals, apples, pears, and so on), the zone ranges of the more important varieties. Fruits having very limited zone ranges, as oranges and guavas, are not included, because they are so easily found under their appropriate zones in the text.

Incidentally, the tables serve to bring out the interesting fact that while a few varieties, as the Red Astrachan apple and Bartlett and Seckel pears, have wide ranges, thriving in as many as three zones, the vast majority are restricted to two, and a considerable number to a single zone.

Additions and corrections are earnestly desired.

CEREALS.

Cereals taken collectively thrive best in cool climates and are most successful in the Transition and Upper Austral zones. This is particularly true of oats and wheat. Corn, while no exception to the rule, has more varieties adapted to the Lower Austral, as appears in the accompanying table.

Zone ranges of oats, wheat, and corn.

[KEY.—(2) and (3) of second or third rate in the area.]

TRANSITION ZONE.

Transition areas as a whole.	Transition areas as a whole.
Oats:	*Wheat*—Continued.
American Banner.	Saskatchewan Fife.
Black Tartarian.	Scotch Fife.
Lincoln.	*Corn:*
Welcome.	Angel of Midnight.
White Russian.	Canadian Eight-Row Yellow Flint.
Wheat:	King Philip.
Australian (3).	Longfellow.
Clawson.	Pride of the North.
Fultz (2).	Squaw.
Ladoga.	Stowell Evergreen (2 and local).
Red Fife.	

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Oats:	*Oats:*
Lincoln (2).	Lincoln (2).
Red Rust Proof.	Red Rust Proof (2).
Welcome.	Welcome (2).
White Russian (2).	White Russian (2).

Zone ranges of oats, wheat, and corn—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Wheat: Clawson. Fulcaster. Fultz. Mediterranean. Turkey Red [Mississippi Valley]. Velvet Chaff.	*Wheat:* Australian. Fultz (*3*). May wheats (*3*). Mediterranean (*2*). Sonora. Turkey Red (*2*). Velvet Chaff (*2*).
Corn: Bloody Butcher. Golden Dent (*2*). Hickory King (*2*). King Philip (*3*). Leaming. St. Charles White [Lower Mississippi Valley] (*2*). Stowell Evergreen. White Gourd Seed (*2*).	*Corn:* Hickory King (*3*). King Philip (*2*). Leaming (*2*). Pride of the North (*3*). Squaw (*3*).

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.
Oats: Red Rust Proof (*2*).	*Oats:* Burt. Red Rust Proof.
Wheat: Australian. Sonora.	*Wheat:* May wheats [away from coast]. Mediterranean (*3*). Fultz (*2*).
Corn: White Gourd Seed (*2*).	*Corn:* Golden Dent. Hickory King. Leaming (*2*). Mosby Prolific. St. Charles White [Mississippi Valley] (*2*). Stowell Evergreen (*2*). White Gourd Seed.

APPLES.

Apples rank among the staple crops of the United States. A multitude of varieties flourish in the Transition and Upper Austral zones and a smaller number in the Lower Austral, as may be seen from the following table. One variety, the Red Astrachan, is remarkable for the wide range of climatic conditions it is able to endure, as it appears to thrive in all the zones and in all the areas except the most arid. Many varieties are restricted to a single zone, but the greater number are common to two adjoining zones, as the Transition and Upper Austral, or the Upper and Lower Austral.

Crab apples are almost restricted to the Transition zone, only four varieties being known to flourish farther south, and all of these are Transition varieties.

Zone ranges of apples.

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only; (*?*), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.

Alexander.
+Bailey *Sweet* (*s*).
+Baker.
+Baldwin.
+Benoni (*s*).
+Bietigheimer (*s*).
+Blenheim.
+Blue Pearmain.
+Bullock (*American Golden Russet*).
+Canada Reinette.
+Chenango (*s*).
+Clyde *Beauty*.
+Cogswell (*s*).
+Danvers (*s*).
+Domine (*s*).
+Dutch Mignonne (*s*).
+Dyer (*Pomme Royal*) (*s*).
+Early Harvest.
+Early Ripe (*s*).
+Early Strawberry (*s*).
+Esopus *Spitzenburg*.
+Ewalt (*s*).
+Fall Pippin.
+Fameuse.
+Garden Royal.
+Golden Russet.
+Golden Russet [New York] (*s*)
+Golden Sweet.
+Gravenstein.
+Green Sweet.
Haas (*Fall Queen*) [Mississippi Valley].
+Hightop *Sweet*.
+Hubbardston.
+Hunt *Russet*.
+Jefferis (*s*).
+Jefferson County.
+Jewett *Red*.
+Jonathan (*s*).
+Keswick (*s*).
Longfield.
+Lowell (*s*).
+McIntosh.
McMahon.
+Maiden Blush (*s*).
+Margaret, *Early Red* (*s*).
+Melon, *Norton* (*s*).
+Minister.
+Montreal Peach.
+Moore Sweet (*s*).
+Mother (*s*).
+Newtown Spitzenburg (*s*).
+Northern Spy.
+Ohio Nonpareil (*s*).
Oldenburg, *Duchess of*.
+Ontario.
+Peck *Pleasant*.
+Perry Russet.
Pewaukee.
+Pomme Gris.
+Porter (*s*).
+Primate (*s*).
+Pumpkin Sweet (*Pound Sweet*).
+Rambo (*s*).
+Red Astrachan.
+Red Canada.
+Rhode Island *Greening*.
+Ribston.
+Rolfe.
Roman Stem.
+Roxbury.
+St. Lawrence.
+Scott Winter.
+Shiawassee.

Arid Transition area.

Alexander.
Baldwin.
Dutch Mignonne.
Dyer (*Pomme Royal*).
Early Harvest.
Early Strawberry.
Esopus *Spitzenburg*.
Fameuse.
Golden Russet.
Golden Sweet.
Gravenstein.
Hightop *Sweet*.
Hubbardston.
Jefferis.
Jonathan.
Keswick.
Longfield.
Lowell.
Maiden Blush.
Monmouth.
Mother.
Newtown Spitzenburg.
Northern Spy.
Oldenburg, *Duchess of*.
Pewaukee.
Porter.
Primate.
Rambo.
Red Astrachan.
Rhode Island *Greening*.
Roman Stem.
Rome Beauty.
Roxbury.
Sops of Wine.
Summer Pearmain
Swaar.
Tetofski.
Tolman *Sweet*.
Tompkins King.
Twenty-Ounce.
Wagener.
Wealthy.
Westfield.
Williams *Favorite*.
Wine, *Hays*.
Winesap (*?*).
Wolf *River*.
Yellow Newtown *Pippin*.
Yellow Transparent.

Pacific Transition area.

Baldwin.
Ben Davis (*s*).
Blue Pearmain.
Early Harvest (*s*).
Esopus *Spitzenburg*.
Fall Pippin (*s*).
Gravenstein.
Jonathan (*s*).
Keswick.
Maiden Blush.
Monmouth.
Northern Spy.
Oldenburg, *Duchess of*.
Rambo (*s*).
Red Astrachan.
Red June (*s*).
Rhode Island *Greening*.
Sops of Wine.
Swaar.
Tompkins King.
Wagener.
Wealthy.
Winesap (*s*).
Yellow Bellflower (*s*).
Yellow Newtown *Pippin* (*s*).
Yellow Transparent.

Zone ranges of apples—Continued.

TRANSITION ZONE—Continued.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
+Sops of Wine.		
+Sterling (*American Beauty*).		
+Summer Pearmain (*s*).		
+Sutton.		
+Swaar (*s*).		
Tetofski.		
+Tolman *Sweet*.		
+Tompkins King.		
+Twenty-Ounce.		
+Vandevere (*s*).		
+Wagener.		
Wealthy.		
Westfield.		
+Williams *Favorite*.		
+Wine, *Hays* (*s*).		
Wolf *River*.		
Yellow Transparent.		
Crab apples:		
Beach.		
Brier.		
+Elgin.		
Excelsior.		
Gibb.		
+Hyslop.		
Martha.		
Marengo.		
Minnesota.		
Montreal.		
Orange.		
Red Siberian.		
Transcendent.		
+Van Wyck.		
Whitney *No. 20*.		
Yellow Siberian.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Arkansas (*Mammoth Black Twig*).	Alameda, *Beauty of*.
Bailey *Sweet*.	Belmont.
Baldwin (*n*).	Ben Davis.
Belmont.	Blue Pearmain.
Ben Davis.	Cook *Seedling*.
Benoni.	Dyer (*Pomme Royal*).
Bentley.	Early Harvest.
Bonum.	Early Pennock.
Bough, *Sweet*.	Early Strawberry.
Bradford *Best* (*Kentucky Red*).	Esopus *Spitzenburg*.
Broadwell.	Fall Jenneting.
Buckingham.	Fall Orange.
Cannon *Pearmain*.	Fall Pippin.
Champlain (*Nyack*).	Fall Wine.
Clayton.	Gloria Mundi.
Cornell *Fancy*.	Golden Russet.
Cullasaga.	Golden Sweet.
Domine (*n*).	Grimes *Golden*.
Dyer (*Pomme Royal*).	Haas (*Fall Queen*).
Early Cooper.	Hawthornden.
Early Harvest.	Hightop *Sweet*.
Early Joe.	Holland *Pippin*.
Early Pennock.	Hubbardston.
Early Strawberry.	Jersey Sweet.
Edward *Early*.	Jonathan.
Esopus (*n*).	Keswick.
Evening Party.	Lady Sweet.
Ewalt.	Lawver (*Delaware Red Winter*).
Fallawater.	Limber Twig.
Fall Orange.	Lowell.
Fall Pippin.	Maiden Blush.
Fall Wine.	McAfee.
Fanny.	Marshall *Red* (*Red Bellflower*).
Fink.	Missouri *Pippin*.
Fulton.	Monmouth *Pippin* (*Red Cheek Pippin*).
Gilpin.	Mother.
Golden Russet (*n*).	Newtown Spitzenburg.
Golden Sweet.	Nickajack.

Zone ranges of apples—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Green Cheese.	Northern Spy.
Green Newtown.	Oldenburg, *Duchess of*.
Grimes *Golden*.	Porter.
Haas (*Fall Queen*).	Primate.
Hewes *Crab*.	Ralls *Genet*.
Hightop *Sweet* [Mississippi Valley].	Rambo.
Hoover.	Red Astrachan.
Horse.	Red Canada.
Hubbardston (*n*).	Red June.
Jefferis.	Rhode Island *Greening*.
Jersey Sweet.	Roman Stem.
Jonathan (*n*).	Rome Beauty.
July (*Fourth of July*).	Smith *Cider*.
Keswick	Summer Pearmain.
Kinnaird.	Summer Queen.
Lady.	Summer Rose.
Lady Sweet.	Swaar.
Lansingburg.	Tetofski.
Late Strawberry.	Tompkins King.
Lawver (*Delaware Red Winter*).	Twenty-Ounce.
Limber Twig.	Wagener.
Lowell.	Wealthy.
McAfee.	Westfield.
McLellan.	White Pearmain.
Maiden Blush.	Wine, *Hays*.
Mangum.	Winesap.
Margaret, *Early Red*.	Wolf *River*.
Milam.	Yellow Bellflower.
Missouri *Pippin*.	Yellow Newtown *Pippin*.
Melon, *Norton* (*n*).	
Monmouth.	
Moore Sweet.	
Mother.	
Newtown Spitzenburg.	
Nickajack.	
Northern Spy (*n*).	
Ohio Nonpareil.	
Oldenburg, *Duchess of*.	
Ontario (*n*).	
Ortley.	
Otoe (*n*).	
Perry Russet (*n*).	
Porter.	
Primate.	
Pryor *Red*.	
Ralls *Genet*.	
Rambo.	
Ramsdell *Sweet*.	
Red Astrachan.	
Red June.	
Red Stripe.	
Rhode Island *Greening* (*n*).	
Romanite, *South*.	
Roman Stem.	
Rome Beauty.	
Shockley.	
Smith *Cider*.	
Smokehouse.	
Sops of Wine (*n*).	
Stark (*n*).	
Summer Pearmain.	
Summer Queen.	
Summer Rose.	
Sutton (*n*).	
Swaar (*n*).	
Sweet Winesap.	
Tetofski.	
Tompkins King (*n*).	
Trenton Early.	
Twenty-Ounce (*n*).	
Vandevere.	
Wagener (*n*).	
Walbridge (*Edgar Red Streak*).	
Westfield (*n*).	
White Juneating.	
White Pearmain.	
White Pippin	
Willow Twig.	
Wine, *Hays* (*n*).	
Winesap.	
Wythe.	

Zone ranges of apples—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Yellow Bellflower. Yellow Newtown *Pippin* (*Albemarle*). Yellow Transparent. York Imperial. *Crab apples:* Hyslop. Martha. Transcendent. Yellow Siberian.	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Marshall *Red* (*Red Bellflower*). Sexton *Golden*. Skinner *Seedling* (*Santa Clara King*). Yellow Bellflower. Yellow Newtown *Pippin*.	Bonum (*n*). Bradford *Best* (*Kentucky Red*). Bruce. Buckingham. Cannon *Pearmain*. Carter Blue. Champlain (*Nyack*) (*n*). Clark Pearmain. Cornell *Fancy* (*n*). Cracking. Cullasaga. Disharoon. Farrar (*Robinson Superb*). Ferdinand. Gilpin (*n*). Green Cheese. Hall. Hockett. Hoover (*n*). Horn. Horse. Jennings. Julian. July (*Fourth of July*) (*n*). Junaluskee. Limber Twig (*n*). McAfee (*n*). Mangum. Manomet. Mason Stranger. Mattamuskeet. Maverack. Nansemond. Nickajack (*n*). Oconee. Oldenburg, *Duchess of*. Ralls *Genet*. Red Astrachan. Red June. Romanite, *South*. Shockley. Stephenson. Switzer [Mississippi Valley]. Taunton. Watson. Waugh *Crab*. White Juneating. Willow Twig. Winesap (*n*). Yates. Yellow June. Yellow Transparent. Yopp. York Imperial (*n*).	Jennings. Red Astrachan.

APRICOTS.

Apricots require a warm climate and do best in the dry summer heat of the Upper and Lower Sonoran areas. They bloom early and are easily injured by frosts, for which reason they are a precarious crop in the Eastern States.

Zone ranges of apricots.

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Alexander [Mississippi Valley].	Alexander.
Breda.	Blenheim.
Budd [Mississippi Valley].	Breda.
Early Golden.	Budd.
Gibb [Mississippi Valley].	Eureka.
Harris.	Gibbs.
Hemskirke.	Hemskirke.
Large Early.	Large Early.
Moorpark.	Montgamet, *Alberge de.*
Peach.	Montgamet Early.
	Moore Early.
	Moorpark.
	Newcastle.
	Peach.
	Pringle.
	Royal Golden, *Brier.*
	St. Ambroise.
	Vestal *Moorpark.*

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.
Breda.	Breda.
Hemskirke.	Early Golden.
Hinds *Seedling.*	Hemskirke.
Montgamet, *Alberge de.*	Moorpark.
Montgamet Early.	Musch.
Moorpark.	Royal Orange.
Peach.	St. Ambroise.
Roman.	Turkey.
Royal.	
Royal Golden, *Brier.*	
St. Ambroise.	
Sparks.	
Vestal *Moorpark.*	

CHERRIES.

Cherries like a warm temperate climate, and do best in the Upper Austral zone, although some varieties flourish in the Transition and others in the Lower Austral. In both of these extremes, however, it will be observed that by far the greater number are confined to those parts of the zones which lie nearest to the Upper Austral (as indicated by the letter (*s*) in the Transition list, and the letter (*n*) in the Austroriparian list).

Zone ranges of cherries.

[Key.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only; (?), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
+Archduke.	Archduke.	Advance, *California.*
Bessarabian.	Choisy, *Belle de.*	Bing.
+Black Heart (*s*).	Ostheimer *Weichsel.*	Centennial.
+Buttner, *Yellow* (*s*).		Coe *Transparent.*
+Choisy, *Belle de.*		Elton.
+Coe *Transparent* (*s*).		Lewelling (*Black Republican*).
+Donna Maria (*s*).		Napoleon (*Royal Ann*).
+Downer (*s*).		Richmond (*Kentish*).
+Dyehouse (*s*).		Rockport.
+Eagle, *Black* (*s*).		Spanish, *Yellow.*
+Early Purple *Guigne* (*s*).		Tartarian, *Black.*
+Elton (*s*).		Windsor.
+Eugenie, *Empress* (*s*).		Wood, *Governor.*
+Florence (*s*).		
+Hortense, *Reine* (*s*)		
+Hovey (*s*).		
Late Kentish.		
Lutovka.		
+Magnifique, *Belle* (*s*).		
+Mayduke (*s*).		
+Montmorency Large.		
+Montmorency Ordinaire.		
Morello, *English.*		
+Napoleon (*s*).		
+Olivet (*s*).		
+Philippe, *Louis* (*s*).		
+Plumstone Morello.		
Richmond (*Kentish*).		
+Tartarian, *Black.*		
+Windsor.		
+Wood, *Governor.*		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Archduke (*n*).	Archduke.
Black Heart.	Bing.
Carnation.	Centennial.
Choisy, *Belle de.*	Choisy, *Belle de.*
Coe *Transparent* (*n*).	Cleveland.
Downer (*n*).	Early Purple *Guigne.*
Dyehouse.	Late Duke.
Eagle, *Black.*	Lewelling (*Black Republican*).
Early Purple *Guigne.*	Mayduke.
Elton (*n*).	Montmorency Large.
Eugenie, *Empress.*	Montmorency Ordinaire.
Hortense, *Reine.*	Morello, *English.*
Knight *Early.*	Napoleon (*Royal Ann*).
Late Kentish.	Olivet.
Magnifique, *Belle.*	Ostheimer *Weichsel.*
Mayduke.	Richmond (*Kentish*).
Morello, *English.*	Rockport.
Napoleon (*Royal Ann*).	Spanish, *Yellow.*
Olivet.	Tartarian, *Black.*
Plumstone Morello.	Thompson *Seedling.*
Richmond.	Windsor.
Rockport (*n*).	Wood, *Governor.*
Spanish, *Yellow.*	
Tartarian, *Black.*	
Windsor.	
Wood, *Governor.*	

Zone ranges of cherries—Continued.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.
Early Purple *Guigne* (?).	Archduke (*n*).
	Black Heart.
	Choisy, *Belle de* (*n*).
	Early Purple *Guigne* (*n*).
	Late Duke.
	Magnifique, *Belle* (*n*).
	Mayduke (*n*).
	Morello, *English* (*n*).
	Richmond (*Kentish*) (*n*).

GRAPES.

Grapes of high excellence and in great variety flourish in all the zones from the Transition to the Lower Austral, inclusive, although no single variety does well in more than two zones. The following table contains only the more important varieties, and might be largely extended, particularly in the Lower Sonoran area:

Zone ranges of grapes.

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*h*), in hottest part only; (*n*), in northern part only; (*s*), in southern part only].

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
Agawam.	Wilder.	Concord.
+Barry.	Worden.	Isabella.
Champion.		Moore *Early*.
Clinton.		
Concord.		
Cottage.		
+Diana.		
+Martha.		
Moore *Early*.		
+Salem.		
Vergennes.		
Victor, *Early*.		
+Wilder.		
Winchell (*Green Mountain*).		
Worden.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Agawam (*n*).	Agawam.
Barry (*n*).	Alexandria, *Muscat of* (*h*).
Brighton.	Black Ferrara.
Catawba.	Black Hamburg.
Champion.	Catawba.
Clinton (*n*).	Chasselas Red.
Concord.	Chasselas Rose.
Cynthiana (*s*).	Concord.
Delaware.	Delaware.
Diamond (*n*).	Elvira.
Diana (*n*).	Emperor (*h*).
Duchess.	Isabella.
Elvira (*s*).	Ives.
Goethe (*s*).	Malaga (*h*).
Iona (*n*).	Massasoit.

Zone ranges of grapes—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.

Isabella.
Ives.
Jefferson.
Lindley.
Missouri Reisling (*s*).
Moore *Early*.
Niagara.
Noah [Southern Mississippi Valley.] (*s*).
Norton *Virginia* (*s*).
Pocklington (*n*).
Prentiss (*n*).
Salem.
Telegraph.
Ulster (*n*).
Worden (*n*).
Wyoming.

Upper Sonoran area.

Mission.
Moore *Early*.
Norton *Virginia*.
Peru, *Rose of* (*h*).
Pierce (*Isabella Regia*).
Prince *Black*.
Royal Muscatine (*h*).
Salem.
Sweetwater (*Fontainebleau*) (*h*).
Thompson *Seedless* (*h*).
Tokay, *Flame* (*h*).
Victor, *Early*.
Worden.
Zinfandel (*h*).

LOWER AUSTRAL ZONE.

Lower Sonoran area.

Alexandria, *Muscat of*.
Black Hamburg.
Emperor.
Feher Szagos.
Gordo Blanco.
Herbemont.
Huasco.
Malaga.
Mission.
Muscat-Hamburg.
Peru. *Rose of*.
Prince. *Black*.
Sultana.
Sweetwater (*Fontainebleau*).
Thompson *Seedless*.
Tokay. *Flame*.
White Muscat.
Zinfandel.

Austroriparian area.

Berckmans.
Brighton (*n*).
Brilliant [Mississippi Valley].
Catawba.
Cynthiana.
Delaware (*n*).
Diamond, *Moore* (*n*).
Elvira.
Flowers.
Goethe (*n*).
Herbemont.
Jefferson (*n*).
Lenoir.
Lindley (*n*).
Missouri Reisling [Mississippi Valley].
Moore *Early* (*n*).
Niagara (*n*).
Norton *Virginia*.
Salem (*n*).
Scuppernong.
Tenderpulp.
Thomas.
Triumph.
Wylie, *Peter*.

Gulf strip.

Elvira.
Flowers.
Herbemont.
Norton *Virginia*.
Scuppernong.
Tenderpulp.
Thomas.
Wylie, *Peter*.

PEACHES.

Peaches require a warm climate, and are one of the most important fruits of the Upper and Lower Austral zones. In the Transition zone, except along the southern edge, where the Transition shades into the Upper Austral, they can not be depended on. But in the Pacific Coast division of the Transition, which, as elsewhere explained, receives more heat than the other parts of this zone, peaches are grown in certain localities, and the Hale is said to do well.

Nectarines follow peaches, except in the humid areas, but are of little consequence in the Eastern States. They reach their highest development and greatest commercial consequence in the arid Lower Sonoran.

Zone ranges of peaches.

[KEY.—(*n*), in northern part only.]

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Alexander.	Alexander.
Beers *Smock*.	Beers *Smock*.
Bilyeu.	Bilyeu.
Chili, *Hills*.	Brandywine.
Early Crawford.	Chair *Choice*.
Elberta.	Early Crawford.
Foster.	Early York.
George IV.	Elberta.
Globe.	Foster.
Golden Drop.	Garey.
Grosse Mignonne.	Garfield.
Hale.[1]	Garland, *Governor*.
Heath *Cling*.	Globe.
Hoover.	Golden Cling.
Kenrick *Heath*.	Hale.[1]
Large York.	Heath *Cling*.
Late Admirable.	Late Crawford.
Late Crawford.	Lovell.
Late Rareripe.	Malta.
Morris *White*.	McKevitt *Cling*.
Mountain Rose.	Muir.
Oldmixon Cling.	Newhall.
Oldmixon Free.	Nichols *Cling*.
Red Cheek *Melocoton*.	Orange Cling.
Reeves *Favorite*.	Picquet *Late*.
Richmond.	Reeves *Favorite*.
Rivers.	Rivers.
Salway.	Runyon *Orange Cling*.
Smock.	St. John, *Yellow*.
Sneed.	Salway.
Stevens *Rareripe*.	Smock.
Strawberry.	Strawberry.
Stump.	Stump.
St. John, *Yellow*	Susquehanna.
Susquehanna.	Tuskena (*Tuscany*).
Nectarines:	Waterloo.
Boston.	Wilkins.
Elruge.	*Nectarines:*
Stanwick.	Hunt *Tawny*.
	Red Roman.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Alexander.	Alexander (*n*).	Angel.
Early Crawford (*n*).	Amelia.	Bidwell Early (*P*).
Early York.	Austin.	Bidwell Late (*P*).
Elberta.	Blood Cling.	Cabler *Indian*.
Foster (*n*).	Blood Free.	Climax.
Garland, *Governor*.	Cabler *Indian*.	Countess.
Hale.	Chinese *Cling*.	Early China (*P*).
Heath *Cling*.	Columbia.	Ferdinand.
Henrietta.	Early Crawford (*n*).	Florida Crawford.
Late Crawford (*n*).	Early York (*n*).	Gibbon.
Lemon Cling.	Elberta.	Honey.
Muir.	Hale (*n*).	Imperial.
St. John, *Yellow*.	Heath *Cling* (*n*).	Maggie *Burt*.
Strawberry.	Hoover.	Onderdonk.
Susquehanna.	Kerr, *Jessie*.	Pallas.
Nectarines:	Late Crawford.	Peen-to (*P*).
Boston.	Lee, *General*.	Waldo.
Downton.	Lemon Cling.	
Early Newington.	Mountain Rose (*n*).	
Early Violet.	Oldmixon Cling (*n*).	
Elruge.	Picquet *Late*.	
Hardwicke.	Sneed.	
	St. John, *Yellow*.	
	Thurber.	
	Tillotson.	

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[1] The Hale peach is said to do well in the Pacific Coast Transition area, and is the only peach known to thrive in the Transition zone.

PEARS.

Pears thrive best in the Transition and Upper Austral zones and fairly well in the Lower Austral, though the number of varieties adapted to the latter is relatively small. In the Gulf strip only four varieties flourish.

Zone ranges of pears.

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only; (*?*), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
+Andrews.	Angouleme, *Duchess de.*	Bartlett.
+Angouleme, *Duchess de* (*s*).	Anjou.	Bosc (*s*).
+Anjou (*s*).	Bartlett.	Boussock.
+Bartlett (*s*).	Bosc.	Clairgeau (*s*).
+Bosc (*s*).	Boussock.	Clapp *Favorite.*
+Boussock.	Brandywine.	Flemish *Beauty.*
+Brandywine (*s*).	Clairgeau.	Seckel (*s*).
+Buffum.	Clapp *Favorite.*	Tyson (*s*).
+Clairgeau (*s*).	Columbia.	Winter Nelis (*s*).
+Clapp *Favorite* (*s*).	Easter *Beurre.*	
+Columbia (*s*).	Flemish *Beauty.*	
+Dana Hovey (*s*).	Lawrence.	
+Diel.	Lucrative.	
+Dix.	Onondaga.	
+Elizabeth, *Manning.*	Osband *Summer.*	
+Flemish *Beauty.*	Seckel.	
+Fulton.	Tyson.	
+Giffard (*s*).	Winter Nelis.	
+Goodale.		
+Howell (*s*).		
+Julienne (*s*).		
+Lawrence (*s*).		
+Louise *Bonne de Jersey.*		
+Lucrative (*s*).		
+McLaughlin.		
+Madeleine (*s*).		
+Malines, *Josephine de* (*s*).		
+Onondaga (*s*).		
+Osband *Summer.*		
+Pound.		
+Rostiezer (*s*).		
+Seckel (*s*).		
+Sheldon (*s*).		
+Souvenir *du Congress* (*s*).		
+Sterling.		
+Summer Doyenne (*s*).		
+Tyson.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Angouleme, *Duchess de.*	Angouleme, *Duchess de.*
Anjou (*n*).	Anjou.
Bartlett (*n*).	Bartlett.
Bloodgood.	Bosc.
Bosc (*n*).	Boussock.
Boussock (*n*).	Brandywine.
Brandywine.	Clairgeau.
Buffum (*n*).	Clapp *Favorite.*
Chambers.	Columbia.
Clairgeau (*n*).	Dana Hovey.
Clapp *Favorite* (*n*).	Diel.
Columbia.	Easter *Beurre.*
Comice, *Doyenne du* (*n*).	Flemish *Beauty.*
Diel	Glout Morceau.
Easter *Beurre.*	Idaho [local in Idaho].
Garber.	Lawrence.
Giffard.	Louise *Bonne de Jersey.*
Gray Doyenne (*n*).	Lucrative.
Hosenschenk.	Margaret.

Zone ranges of pears—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Howell.	Onondaga.
Julienne.	Osband *Summer*.
Kieffer.	Patrick Barry.
Kirtland.	Seckel.
Lawrence.	White Doyenne.
Louise *Bonne de Jersey*.	Winter Nelis.
Lucrative (*n*).	Vicar *of Winkfield*.
Madeleine (*n*).	
Malines, *Josephine de* (*n*).	
Marguerite, *Petite* (*n*).	
Mt. Vernon (*n*).	
Napoleon (*n*).	
Onondaga (*n*).	
Osband *Summer*.	
Paradise *d'Automne* (*n*).	
Rostiezer.	
Rutter.	
Seckel.	
Sheldon.	
Summer Doyenne.	
Superfin (*n*).	
Tyson.	
White Doyenne (*n*).	
Winter Nelis.	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Angouleme, *Duchess de*.	Angouleme, *Duchess de* (*n*).	Garber.
Bartlett.	Garber.	Kieffer.
Bosc.	Julienne (*n*).	Le Conte.
Boussock.	Kieffer.	Magnolia.
Brandywine.	Lawrence (*n*).	
Clairgeau.	Le Conte.	
Easter *Beurre*.	Magnolia.	
Glout Morceau.	Rostiezer (*n*).	
Howell (?).	Seckel (*n*).	
Lawrence.	Tyson (*n*).	
Louise *Bonne de Jersey*.		
Lucrative.		
Patrick Barry.		
Pound.		
Seckel.		
Superfin.		
Tyson (?).		
White Doyenne.		
Winter Nelis.		

PLUMS.

Plums have a wide range. They attain their highest development in the Upper Austral zone, but numerous varieties flourish in the Transition and Lower Austral zones. In the dry summer heat of the Upper and Lower Sonoran areas many varieties develop so much sugar that they make the best of prunes, but in the cooler Transition zone and the more humid Carolinian and Austroriparian areas prune culture is not a success.

Zone ranges of plums (including prunes).

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only.]

TRANSITION ZONE.

Alleghanian (eastern) area.

+Arctic, *Moore*.
Aubert, *Yellow*.
+Bavay *Green Gage*.
De Soto.
+Diamond, *Black* (*s*).
+Drap d'Or (*s*).
+Duane *Purple* (*s*).
+Englebert (*s*).
+German *Prune* (*s*).
+Golden Drop, *Coe* (*s*).
+Grand Duke (*s*).
Green Gage.
+Hudson *River Purple Egg* (*s*).
+Hulings *Superb* (*s*).
+Imperial Gage (*s*).
+Jefferson (*s*).
+Kingston (*s*).
+Lawrence *Favorite* (*s*).
Lombard.
+McLaughlin (*s*).
Moldavka.
+Monroe *Egg* (*s*).
+Orleans (*s*).
+Ottoman (*s*).
+Pond (*Hungarian Prune*).
+Purple Gage (*s*).
+Quackenboss (*s*).
Richland.
+Shropshire (*s*).
+Smith Orleans (*s*).
+Transparent Gage (*s*).
+Wales, *Prince of* (*s*).
+Wangenheim (*s*).
+Washington (*s*).
Wolf.
Yellow Egg.

Arid Transition area.

De Soto.
Forest *Garden*.

Pacific Transition area.

Agen (*French*, *Petite*, etc.) (*s*).
Columbia.
Dosch.
Italian (*Fellenberg*).
German *Prune*.
Golden Drop, Coe.
Golden *Prune*.
Pond (*Hungarian Prune*).
Silver *Prune*.
Tragedy.
Yellow Egg.

UPPER AUSTRAL ZONE.

Carolinian area.

Abundance.
Agen (*French*, *Petite*, etc.) (*n*).
Archduke (*n*).
Bavay *Green Gage* (*n*).
Bleecker *Gage* (*n*).
Bradshaw (*n*).
Burbank.
Chabot.
Clinton.
Columbia (*n*).
Copper (*n*).
Damson.
Diamond, *Black* (*n*).
Drap d'Or (*n*).
Duane *Purple* (*n*).
Englebert (*n*).
German *Prune* (*n*).
Golden Drop, *Coe*.
Grand Duke (*n*).
Hand (*n*).
Hudson *River Purple Egg* (*n*).
Hulings *Superb* (*n*).
Imperial Gage (*n*).
Italian (*Fellenberg*) (*n*).
Jefferson.
Kerr (*Hattankio 2*).
Kingston (*n*).
Lawrence *Favorite* (*n*).
Lombard.
Miner.
Monroe *Egg* (*n*).
Newman.

Upper Sonoran area.

Agen (*French*, *Petite*, etc).
Bavay *Green Gage*.
Bradshaw.
Cherry.
Clyman.
Columbia.
German *Prune*.
Golden Drop, *Coe*.
Golden *Prune*.
Imperial *Gage*.
Italian.
Kanawha.
Lombard.
McLaughlin.
Peach.
Pond (*Hungarian Prune*).
Sergent, *Robe de*.
Shropshire.
Silver *Prune*.
Tragedy.
Washington.
Yellow Egg.

Zone ranges of plums (including prunes)—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Ogon.	
Orleans (*n*).	
Ottoman (*n*).	
Peach (*n*).	
Prince *Yellow*.	
Purple Favorite (*n*).	
Purple Gage (*n*).	
Red Nagate.	
Richland (*n*).	
Robinson.	
Saratoga (*n*).	
Saunders (*n*).	
Satsuma.	
Shropshire.	
Smith Orleans (*n*).	
Transparent *Gage* (*n*).	
Washington (*n*).	
Wales, *Prince of* (*n*).	
Wangenheim (*n*).	
Wild Goose.	
Willard.	
Yellow Egg (*n*).	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Agen (*French, Petite,* etc.).	Abundance (*Botan.*).	Kelsey.
Caddo Chief.	Burbank.	Satsuma.
Columbia.	Caddo Chief [western].	Wild Goose.
El Paso.	Caradeuc, *De.*	
German *Prune.*	Chabot.	
Golden Drop, *Coe.*	Cumberland.	
Italian (*Fellenberg*).	El Paso [western].	
Jefferson.	Georgeson (*Hattankio*).	
Peach.	Golden Beauty.	
Sergent, *Robe de.*	Kerr (*Hattankio 2*).	
Simon (*Prunus simonii*).	Indian Chief.	
	Lone Star.	
	Marianna.	
	Miner.	
	Newman.	
	Red Nagate.	
	Satsuma.	
	Transparent, *Yellow.*	
	Weaver.	
	Wild Goose.	

STRAWBERRIES.

Strawberries taken collectively have a wide range, special varieties being commercially profitable in every zone from the lower edge of the Boreal in Canada to the semitropical strip bordering the Gulf of Mexico. Nevertheless, the strawberry is the product of cool temperate climates, and by far the larger number of varieties are found in the Transition and Upper Austral zones.

Zone ranges of strawberries.

[KEY.—(*n*), in northern part only; (*s*), in southern part only; (*?*), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
Bubach *No. 5.*	Bubach *No. 5.*	Bubach *No. 5*
Crescent.	Captain Jack.	Clark *Seedling.*[1]
Cumberland.	Jessie (*?*).	Crescent.
Downing, *Charles.*		Everbearing.
Eureka (*s*).		Jessie.
Haverland.		Monarch.
Jessie.		Perry.
Michel *Early* (*s*).		Sharpless.
Miner.		Vick.
Sharpless.		Wilson *Albany.*
Warfield.		
Wilson.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Bubach *No. 5.*	Bubach *No. 5.*
Crescent.	Captain Jack.
Cumberland.	Clark *Seedling.*[1]
Downing, *Charles.*	Crawford.
Enhance.	Jessie.
Eureka.	Longfellow.
Gandy.	Monarch.
Greenville.	Parker Earle.
Haverland.	Sharpless.
Jersey *Queen.*	Thompson *No. 7.*
Jessie.	
Michel *Early.*	
Miner.	
Parker Earle.	
Sandoval.	
Sharpless.	
Warfield.	
Wood, *Beder.*	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Australian *Crimson.*	Bubach *No. 5* (*n*).	Hoffman.
Burt.	Cloud [Mississippi Valley].	Michel *Early.*
Longfellow.	Crescent.	Neunan.
Monarch.	Gandy (*n*).	Thompson, *Lady.*
Sharpless.	Hoffman.	
	Michel *Early.*	
	Parker Earle.	
	Thompson, *Lady.*	
	Warfield [Mississippi Valley].	

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[1] Markedly successful at Hood River, Oregon, where the Pacific or humid division of the Transition zone merges into the arid Upper Sonoran.

NUTS.

Our native wild nuts, of which the butternut, chestnut, hazelnut, hickorynut, and black walnut are of some commercial importance, are not included in the table, which treats of cultivated kinds only.

Peanuts are grown on a small scale in hot localities in the Carolinian area, in Michigan and Nebraska, and to a greater extent in New Jersey and Delaware, but belong properly to the Austroriparian. Pecans thrive in the Austroriparian and Lower Sonoran areas, but do best in the Gulf strip. Almonds, though grown sparingly in the Austroriparian area, do not fruit well, and are not a commercial success except in the Lower Sonoran area of California and Arizona, where they and English walnuts are very important crops.

Zone ranges of nuts.

[KEY.—(*h*), in hottest part only.]

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Peanuts (*h*).	*European walnuts:* Chaberte. Franquette. Mayette. Parisienne. Prœparturiens. Serotina. *European chestnuts:* Combale, *Marron*. De Lyon, *Marron*. *Filberts and hazelnuts:* Du Chilly. Lambert. Piedmont. Purple Leaf. Red Aveline.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Almonds: Blowers. Brier. Drake. Golden State. Gray [southwestern Utah]. Harriott. IXL. King *Soft Shell*. Languedoc. Lewelling. McCoy. Ne Plus Ultra. Nonpareil (*Extra*). Paper Shell. Routier, *New*. Soft Shell, *Routier*. Supremo. Tarragona. Twin, *Routier*. *European walnuts:* Bijou. Chaberte. Cluster. Ford. Franquette. Gant (*Bijou*). Kaghazi. Mayette. Mesange (*Paper Shell*). Mission (*Los Angeles*). Parisienne Prœparturiens. Santa Barbara. Serotina. *Peanuts.* *Pecans.* *Pistachio nut.*	*Almonds.*[1] *English walnuts.*[1] *Peanuts.* *Pecans.*	*Peanuts.* *Pecans.*

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[1] Not commercially grown in the Austroriparian area.

MISCELLANEOUS CROPS.

This list is only the merest skeleton. Additions of all kinds, particularly specific information respecting the ranges of definite varieties of garden vegetables, will be thankfully received.

Zone ranges of miscellaneous crops.

[KEY.—(*h*), in hottest part only; (*n*), in northern part only; (*s*), in southern part only.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
Flax (*s*). Hops. Maple sugar. Sorghum (*s*). Sugar beet. Sweet corn. White potatoes.	Flax. Sugar beet. White potatoes.	Alfalfa (*s*). Hops. Sugar beet (*s*). Sweet corn. White potatoes.

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Cowpeas. Flax. Hemp (Cannabis sativa). Lima beans. Sorghum. Sugar beet. Sweet potatoes (*h*). Tobacco. White potatoes.	Alfalfa. Cowpeas. Kafir corn. Hemp. Lima beans. Sorghum. Sugar beet (*n*). Sweet potatoes. Tobacco White potatoes.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Alfalfa. Black wattle. Canaigre. Castor bean. Cork oak. Cotton. Cowpeas. Flax (seed). Hemp. Mustard. Olive oil. Opium poppy. Pyrethrum. Ramie. Roselle. Sorghum. Sugar cane. Sweet potatoes. Tagasaste. Tobacco.	China grass. Castor bean. Cotton. Cowpeas. Jute. Lima beans. Rice. Sorghum. Sugar cane. Sweet potatoes. Tea. Tobacco. Turpentine.	China grass (for fiber). Cotton. Jute. Rice. Sea Island cotton. Sorghum. Sugar cane. Sweet potatoes. Tobacco.

TROPICAL FLORIDA.

Camphor. Coffee. Ramie. Sisal hemp. Tobacco.

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Frank Baker

BULLETIN No. 11.

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF BIOLOGICAL SURVEY

THE
Geographic Distribution of Cereals in North America

BY

C. S. PLUMB, B. S.

DIRECTOR, INDIANA AGRICULTURAL EXPERIMENT STATION
PURDUE UNIVERSITY, LAFAYETTE, IND.

PREPARED UNDER THE DIRECTION OF
DR. C. HART MERRIAM
CHIEF OF BIOLOGICAL SURVEY

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1898

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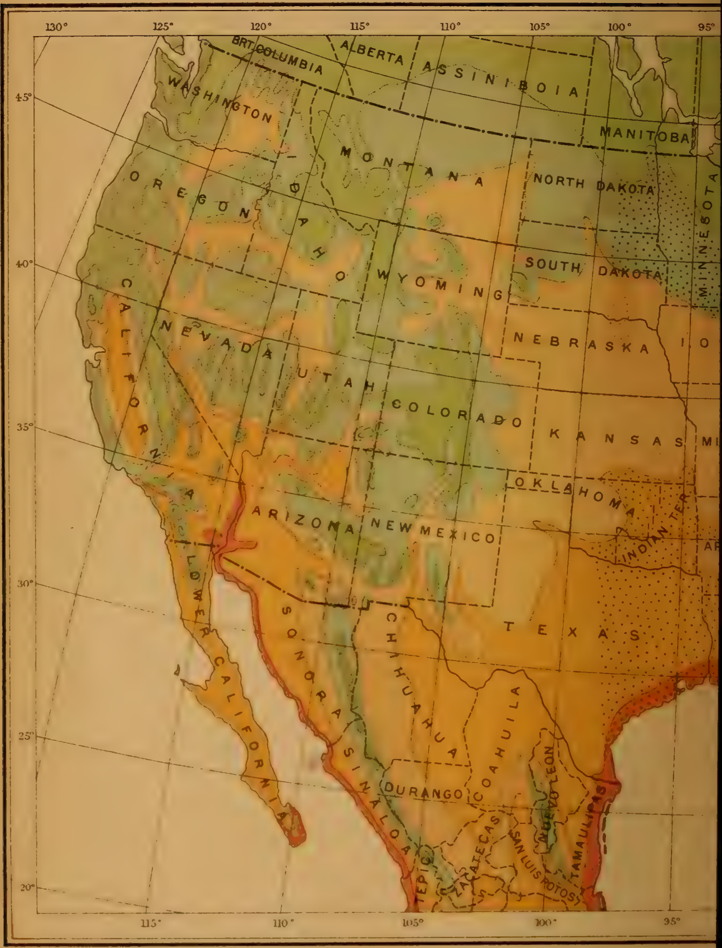
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OREGON
IDAHO
WYOMING
SOUTH DAKOTA
CALIFORNIA
NEVADA
UTAH
NEBRASKA
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COLORADO
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INDIAN TER.
AR
ARIZONA
NEW MEXICO
TEXAS
LOWER CALIFORNIA
SONORA
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SAN LUIS POTOSI
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Corrected to December, 1897.

LIFE ZONES OF T

C. HART

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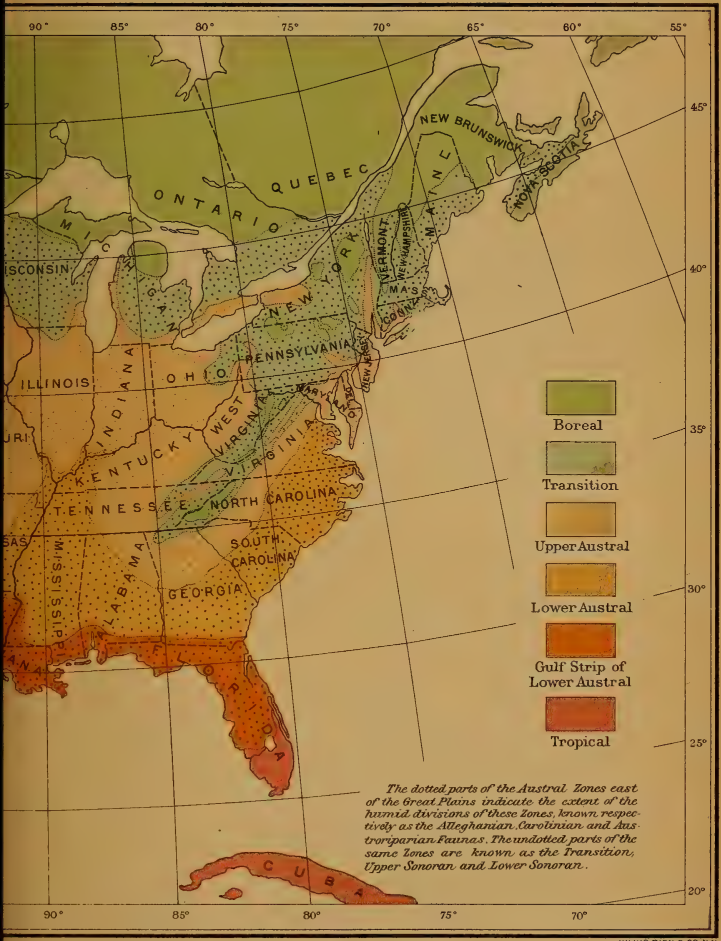
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ONTARIO
NEW BRUNSWICK
NOVA SCOTIA
MAINE
MICHIGAN
WISCONSIN
NEW YORK
VERMONT
NEW HAMPSHIRE
MAS
CONN.
PENNSYLVANIA
NEW JERSEY
MARYLAND
DEL.
OHIO
ILLINOIS
INDIANA
URI
WEST VIRGINIA
VIRGINIA
KENTUCKY
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
SAS
ANA
FLORIDA
CUBA
🟩 Boreal
▨ Transition
▨ Upper Austral
▨ Lower Austral
🟧 Gulf Strip of Lower Austral
🟥 Tropical

The dotted parts of the Austral Zones east of the Great Plains indicate the extent of the humid divisions of these Zones, known respectively as the Alleghanian, Carolinian and Austroriparian Faunas. The undotted parts of the same Zones are known as the Transition, Upper Sonoran and Lower Sonoran.

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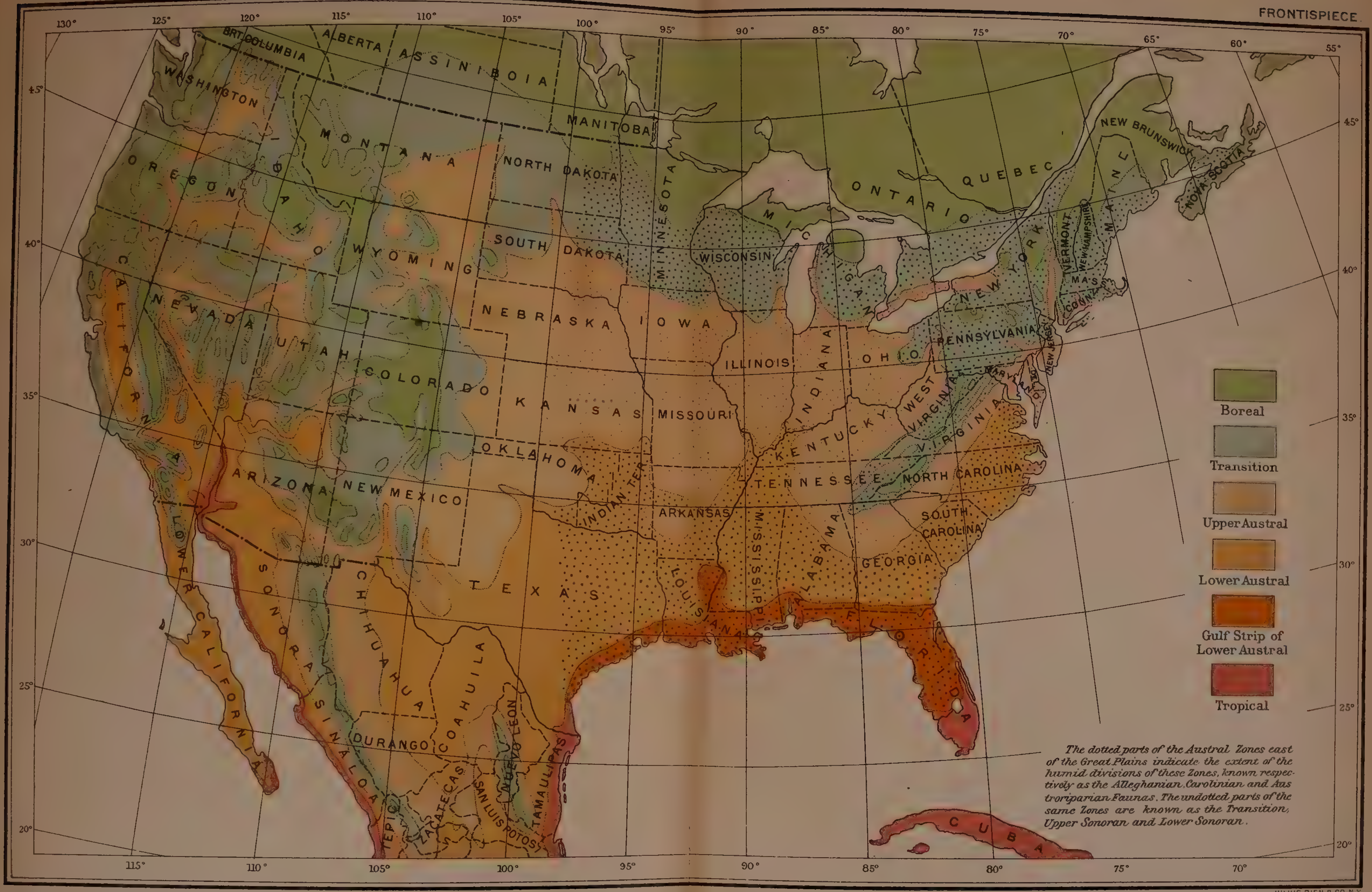
Boreal
Transition
Upper Austral
Lower Austral
Gulf Strip of Lower Austral
Tropical
BRIT. COLUMBIA
ALBERTA
ASSINIBOIA
MANITOBA
ONTARIO
QUEBEC
NEW BRUNSWICK
NOVA SCOTIA
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
WISCONSIN
MICHIGAN
NEW YORK
VERMONT
NEW HAMPSHIRE
MAINE
MASS.
CONN.
CALIFORNIA
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
NEW JERSEY
MARYLAND
WEST VIRGINIA
VIRGINIA
KANSAS
MISSOURI
KENTUCKY
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
ARIZONA
NEW MEXICO
OKLAHOMA
INDIAN TER.
ARKANSAS
MISSISSIPPI
ALABAMA
GEORGIA
TEXAS
LOUISIANA
FLORIDA
LOWER CALIFORNIA
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
DURANGO
SINALOA
ZACATECAS
SAN LUIS POTOSI
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Corrected to December, 1897.

JULIUS BIEN & CO. N.Y.

LIFE ZONES OF THE UNITED STATES
BY
C. HART MERRIAM.

BULLETIN NO. 11.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

THE

Geographic Distribution of Cereals in North America

BY

C. S. PLUMB, B. S.
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DR. C. HART MERRIAM
CHIEF OF BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1898

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., June 26, 1898.

Sir: I have the honor to transmit herewith, for publication as Bulletin No. 11 of the Biological Survey, a report on 'The Geographic Distribution of Cereals in North America,' by Prof. C. S. Plumb, the result of an investigation made under an authorization of the Secretary of Agriculture under date of January 2, 1897. The object of the inquiry was to ascertain the areas in which the more important varieties of certain cereals were cultivated and to determine how far the distribution of cereals accords with the boundaries of the life zones as mapped by the Biological Survey.

This report was received a year ago, but its publication has been delayed in order that it might be accompanied by a revised map of the life zones, necessary to its proper comprehension.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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THE GEOGRAPHIC DISTRIBUTION OF CEREALS IN NORTH AMERICA.

INTRODUCTION.

Through the assistance of the experiment stations in the United States and Canada, and in a few cases through secretaries of boards of agriculture, were secured the addresses of about twenty-five hundred intelligent corn, wheat, and oat growers throughout the two countries. To each of these persons was sent a circular letter explaining the object of the inquiry, and requesting that the blanks on the form accompanying the letter be filled out with the names of not more than ten well-established varieties each of corn, wheat, and oats which were grown most successfully in the neighborhood reported on, together with a statement as to how long the variety had been known, the average yield, and whether it succeeded best on lowland or upland.

Of the 1,033 reports received, 897 came from the United States, (representing all the States and Territories), and 136 from the Canadian provinces of British Columbia, Alberta, Saskatchewan, Assiniboia, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. A large percentage of the replies were very intelligently made, and many blanks were completely and carefully filled.

These reports showed that in many localities but little attention was given to keeping varieties pure, and many farmers used mixed, unknown, or local varieties of ordinary merit for seed. In the East and South this was more frequently the case than in the Central, Northern, and Western States, or in the Canadian provinces. In most of the Eastern and Southern States, as compared with the rest of the country, grain growing is not an important industry. In New England but little grain is grown for seed, owing to the cheapness of Western grain, and wheat was rarely reported. Oats are now mostly sown from Western seed, the resulting crop being mown for hay, while much of the corn is cut for green fodder or silage. On certain fine lowlands, as, for example, in the Connecticut Valley, oats, and more especially corn, are often grown for grain.

While reports on most of the cereals were rendered from the Lower Austral zone,[1] this region, except where it merges with the Upper

---

[1] North America is divisible into seven transcontinental belts or life zones, each characterized by particular associations of animals and plants and suited for special crops. These zones are: The Arctic-Alpine, Hudsonian, Canadian, Transition, Upper Austral, Lower Austral, and Tropical. The Transition, Upper and Lower Austral are the ones most frequently referred to in this bulletin (see frontispiece). The Life Zones and Crop Zones of the United States are described in detail in Bulletin No. 10 of the Biological Survey.

Austral, is apparently outside the area of profitable cultivation of wheat and oats. In Louisiana wheat is almost an unknown crop, and the same may be said of most other parts of the Lower Austral, except in northern Texas and Oklahoma. The warm, moist summer climatic conditions here favor the development of fungous diseases to such a degree that the plants are usually ruined or greatly injured at an early stage of growth. In Florida, as a rule, cereals are rarely cultivated, except on the uplands at the northern end of the State. Both corn and oats make an unsatisfactory growth compared with that in the Upper Austral, while wheat is not grown at all on a commercial scale.

The only class of oats that yield crops of any consequence in the oat-growing territory in the Lower Austral zone are the so-called rust-proof varieties, chief among which is the Texas Red Rust Proof, commonly grown in all the Gulf States.

In a general way, corn and wheat are most successfully grown in the Upper Austral zone, while oats are best and most productive in the Transition zone, or along the border of the Upper Austral and the Transition.

The gradual acclimation of varieties of cereals, through years of selection and cultivation, has gone so far, however, that some varieties are now much better adapted to one zone than to another. The Flint corns come to their best development in the higher Upper Austral and Transition, while Mosby's Prolific of the Dents clings close to the Lower Austral. Burt oats thrive best in the higher Lower Austral, while Black Tartarian reaches greatest perfection in the Transition. These examples are given simply to show the adaptability of varieties to certain zones.

GEOGRAPHIC DISTRIBUTION.

In the following discussion only those varieties are included which are recognized as standard ones by seedsmen and grain growers generally. Many others were reported on, but in no instance were enough returns received concerning any one to justify mapping its geographic distribution. It is but fair to assume that the reports represent the relative importance of the different varieties over the country in general. It is not intended, however, that the impression shall be created that many of them will or will not thrive in localities from which no reports have been received. It is believed that enough facts have been secured to demonstrate that, in their present stage of development, the varieties here mentioned are better suited to successful cultivation in the zones from which they are favorably reported than in other areas.

A discussion of each variety follows, based on a careful study of a map showing its distribution and data concerning its maturing or productive powers in the regions where grown. On the basis of this evidence it is believed that the varieties may be classified according to their adaptability to successful culture in the several life zones.

The following table has been prepared to show the zones in which each variety of corn, wheat, and oats reported on seems to be best adapted.[1] A list of the varieties of cereals specially adapted to each zone is given in the table on page 22.

Distribution of Cereals in North America, by Varieties.

Cereal.	Group.	Variety.	Zone.
Corn	(*a*) Flint	Angel of Midnight	Transition and upper edge of Upper Austral.
		Canadian Eight-rowed Yellow.	Transition and upper edge of Upper Austral.
		King Philip	Transition and upper edge of Upper Austral.
		Longfellow	Transition and upper edge of Upper Austral.
	(*b*) Dent	Bloody Butcher	Upper Austral.
		Golden Dent	Lower Austral and lower edge of Upper Austral.
		Hickory King	Upper Austral and upper part of Lower Austral.
		Leaming	Upper Austral.
		Mosby's Prolific	Lower Austral.
		Pride of the North	Transition.
		St. Charles White	Upper Austral.
		White Gourd Seed	Where Upper and Lower Austral blend.
	(*c*) Soft	Squaw	Transition.
	(*d*) Sweet	Stowell's Evergreen	Upper Austral.
	(*e*) Pop	All varieties	Upper Austral.
Wheat	(*a*) Winter	Clawson	Transition and Upper Austral.
		Fulcaster	Upper Austral.
		Fultz	Upper Austral.
		May	Lower Austral and lower edge of Upper Austral.
		Mediterranean	Upper Austral.
		Turkey Red	Upper Austral.
		Velvet Chaff	Upper Austral.
	(*b*) Spring	Australian	Lower and Upper Austral.
		Ladoga	Transition.
		Saskatchewan Fife	Transition.
		Scotch Fife. Fife	Transition.
		Sonora	Upper and Lower Austral.
		Red Fife	Transition.
Oats	(*a*) Open panicle	American Banner	Transition.
		Lincoln	Transition and Upper Austral.
		Welcome	Transition and Upper Austral.
		Burt	Lower Austral.
		Red Rust Proof	Where Upper Austral and Lower Austral blend.
	(*b*) Closed panicle	White Russian	Transition and Upper Austral.
		Black Tartarian	Transition.

CORN.

Indian corn is known botanically as *Zea mays* Linn. The varieties of this species are many, and may be subdivided into five principal groups, viz: Flint, Dent, Soft, Sweet, and Pop. There is one other group, known as *Pod* corn, which, however, does not find a place in our agriculture. Sturtevant also places in a group by itself, under the name of Starchy Sweet corns, the varieties grown by the Indians of Arizona, New Mexico, and Mexico. In this report are considered only the Flint, Dent, Soft, Sweet, and Pop varieties. For convenience, each is placed in its proper group, and discussed separately.

---

[1] No doubt occasionally varieties were incorrectly named by correspondents, but such errors are probably so small as not to be worthy of serious consideration.

GROUPS AND VARIETIES.

(*a*) FLINT CORN.

(1) Angel of Midnight.
(2) Canadian Eight-rowed Yellow.
(3) King Philip.
(4) Longfellow.

(*b*) DENT CORN.

(5) Bloody Butcher.
(6) Golden Dent.
(7) Hickory King.
(8) Leaming.
(9) Mosby's Prolific.

(*b*) DENT CORN—Continued.

(10) Pride of the North.
(11) St. Charles White.
(12) White Gourd Seed.

(*c*) SOFT CORN.

(13) Squaw.

(*d*) SWEET CORN.

(14) Stowell's Evergreen.

(*e*) POP CORN.

(15) All varieties.

NOTES ON THE GROUPS AND VARIETIES.

The geographic distribution of the above-mentioned varieties is given in order, as follows:

(*a*) FLINT CORN.

Flint corn comprises a comparatively small amount of the corn of commerce, and is generally grown in the Transition zone in the Northeastern States and Canada.

(1) *Angel of Midnight.*—Reported by twenty-four persons as growing and maturing grain in Colorado, Connecticut, Massachusetts, New York, Rhode Island, Utah, Vermont, Wisconsin, and Ontario. It is also reported as grown for green fodder in British Columbia, Saskatchewan, New Brunswick, Nova Scotia, and Manitoba, where it will not mature seed. It is commonly grown in Massachusetts and Connecticut, but elsewhere only in widely separated localities. All reports where it matures are from points in the Transition zone and in the higher limits of the Upper Austral.

(2) *Canadian Eight-rowed Yellow.*—This is also known as Canada Yellow, Canadian Yellow, Early Canada, etc. Thirty-eight persons report this variety, or one closely related to it, as growing in all the New England States, in Missouri, Nevada, Ohio, Pennsylvania, Utah, Washington, Ontario, Quebec, and New Brunswick. It is, however, a standard stock corn of New England and the eastern Canadian provinces, and, in some cases, has been grown in the Northeast for nearly a century. While it will yield satisfactory crops in the upper edge of the Upper Austral, it is essentially a plant of the Transition zone. The one report from Missouri probably names the variety incorrectly.

(3) *King Philip.*—This variety was first distributed in the United States in 1852, and is to-day one of the best-known Flint varieties, being extensively grown in the Northeastern States, where it is highly regarded. Forty-six correspondents report it as growing in nineteen States and in the Province of Ontario. It is widely scattered (in the Transition and to some extent in the Upper Austral zones) from the

Atlantic to the Pacific. Besides the New England States, it is reported from northern New Jersey, Pennsylvania, New York, southern Michigan, Wisconsin, and from one point each in northern Missouri, central Kansas, North Dakota, South Dakota, Colorado, and Idaho. It grows in California near the coast at a number of points in the Upper Austral zone and at one point in the Transition; at four points in the Transition in Oregon and one point in Colorado. In Minnesota it is reported entirely from the Transition, while in Utah reports are from both the Upper Austral and Transition zones. The Ontario reports are from the Upper Austral.

(4) *Longfellow.*—This variety has been known in New England for nearly sixty years, and is a favorite, being generally cultivated all over that section. It is also reported maturing seed in northern Colorado, Utah, Idaho, North Dakota, Minnesota, Wisconsin, Pennsylvania, and northern New Jersey. These localities are nearly all in the Transition zone, except in the Connecticut Valley, and possibly one point in Venango County, Pa., which are in the Upper Austral. Reports from Manitoba, Nova Scotia, and British Columbia state that it is only grown for green fodder. Reports from Ontario, Quebec, and New Brunswick give yields of grain in the Transition zone ranging from 30 to 90 bushels per acre. Generally speaking, it is a variety of the Transition zone, and also of the edge of the Upper Austral.

(*b*) DENT CORN.

(5) *Bloody Butcher.*—Forty-five persons report this variety from thirteen States and Territories, mainly in the central West, and with slight exception, entirely in the Upper Austral. One report from Ashtabula County, Ohio, places it in the Transition zone, while eight persons in Oklahoma report it a standard variety in the Lower Austral, along the border of the Upper Austral. The reports, however, from Oklahoma, indicate unprofitable culture. Bloody Butcher is clearly an Upper Austral variety grown mainly in Indiana, Illinois, Iowa, Kansas, and Nebraska.

(6) *Golden Dent.*—Thirty-three persons report this variety from sixteen States. It is reported mostly from the Lower Austral zone in Texas, Louisiana, Arkansas, Mississippi, Alabama, Georgia, Florida, North Carolina, and South Carolina. It is also reported from the Upper Austral in Arkansas, Illinois, North Carolina, South Carolina, Ohio, Virginia, West Virginia, Pennsylvania, and New Jersey. One New Jersey correspondent writes that it is uncertain in ripening in Morris County. Golden Dent is evidently well suited to the Lower Austral zone, though it may do well in the Upper Austral if not carried too far toward the Transition.

(7) *Hickory King.*—Sixty-one persons report this variety grown in twenty-two States and Territories, in the main, in the lower part of the

Upper Austral zone, and in the Lower Austral in Louisiana, Mississippi, Alabama, Texas, and Oklahoma. The reports from the Lower Austral are, however, generally unsatisfactory in productiveness, and do not indicate a high yield. The reports from the Upper Austral indicate that it is better adapted to the lower part of that zone, especially in Indiana, Kansas, Kentucky, Missouri, Nebraska, Virginia, West Virginia, and Delaware.

(8) *Leaming.*—This is one of the very best known, most widely grown, and most productive of the Dent corns. A number of correspondents report having grown it as long as twenty-five years. One hundred and thirty-one persons state that this variety is grown, with minor exceptions, in the Upper Austral zone up to its northern border, especially in Ohio, Indiana, Illinois, Iowa, Arkansas, Kansas, Nebraska, Pennsylvania, Maryland, and New Jersey. Leaming is *reported* as ripening all over Massachusetts, except in Suffolk, Barnstable, and Nantucket counties, although it is very unlikely that it will ripen anywhere in the Transition. It is said to yield well in Dakota County, Minn., which is near the boundary of the Upper Austral zone. Reports from New Mexico, Utah, Idaho, and Colorado also seem to come from points within the Upper Austral. Eight reports show that it yields crops in Texas, Oklahoma, Louisiana, Mississippi, and Alabama, all in the Lower Austral, but as a rule the yields are much inferior to those in the Upper Austral, to which zone this variety clearly belongs. (See fig. 1, p. 11.)

(9) *Mosby's Prolific.*—This variety seems to be quite restricted in geographic distribution, thirty-two persons reporting it from five States—Alabama, Arkansas, Louisiana, Mississippi, and South Carolina. But one report was received from Arkansas, one from South Carolina, while thirty came from Louisiana, Mississippi, and Alabama. These reports, with the exception of that from South Carolina, are all from the Lower Austral zone, to which Mosby's Prolific is evidently best adapted.

(10) *Pride of the North.*—This is one of the few Dent varieties that seem adapted to the border of the Upper Austral and Transition zones. Sixty-two persons report that it is grown successfully in nineteen States and in the province of Ontario. With five exceptions, all these points are in the more northern States, notably Massachusetts, New York, Ohio, Indiana, Illinois, Iowa, Nebraska, South Dakota, Minnesota, Wisconsin, and Michigan. Pride of the North is reported in the Transition zone in northern South Dakota, at three points in Minnesota, at a number in Wisconsin, at one in Ohio, and at one in Ontario. It is reported to succeed all over Massachusetts, except Suffolk, Barnstable, and Nantucket counties, but it is doubtful if it will ripen outside of the valleys in that State. This variety does best in the Transition and along the upper edge of the Upper Austral zones. (See fig 1, p. 11.)

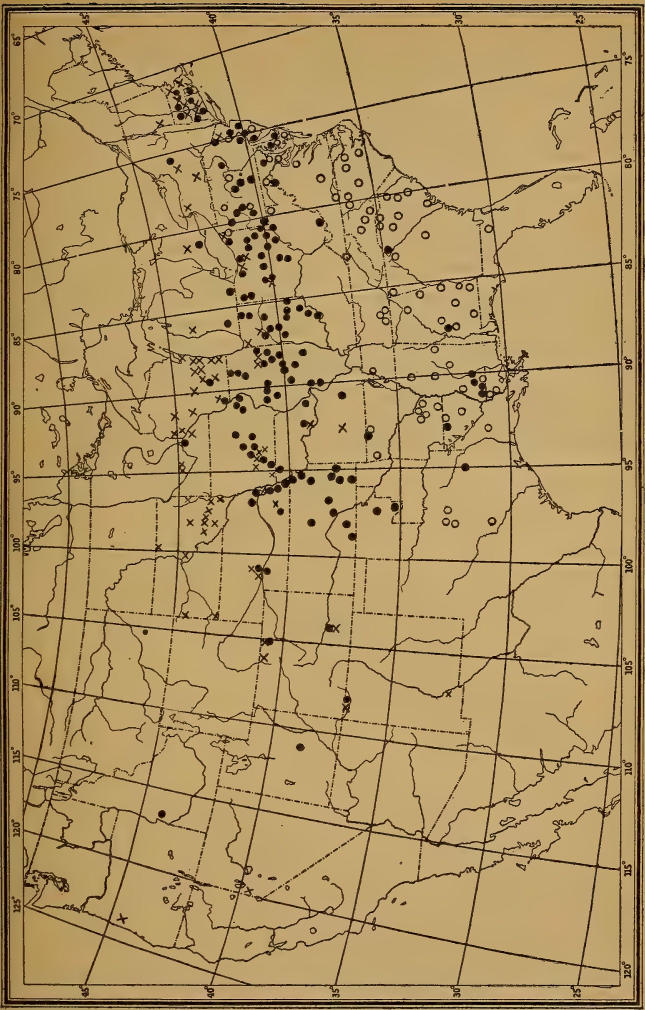
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FIG. 1.—Map showing distribution of three varieties of Corn: Cross (+) = Pride of the North. Spot (●) = Leaming. Circle (○) = White Gourd Seed.

(11) *St. Charles White.*—This is quite a well-known variety in the Mississippi Valley States south of Iowa. Twenty-three persons report it from seven States and Oklahoma. Three reports from southern Oklahoma, northern Louisiana, and southern Alabama, come from the Lower Austral zone, the other twenty from the lower part of the Upper Austral, in Kansas, Missouri, Arkansas, Illinois, Tennessee, and northern Alabama. St. Charles White may be regarded as an Upper Austral type since two of the three yields reported from the Lower Austral (Louisiana and Alabama) can hardly be regarded as within the limits of successful or profitable culture.

(12) *White Gourd Seed.*—This variety is also known as Gourd Seed, Improved Gourd Seed, Southern Gourd Seed, Big Gourd Seed, Large Gourd Seed, etc. It is essentially a southern corn, that is generally grown in the Gulf and lower Atlantic seaboard States. Sixty-nine reports on it were received from seventeen States, including one each from California, Ohio, and Florida. In the Lower Austral zone White Gourd Seed succeeds in Texas, Louisiana, southern Arkansas, western Tennessee, Mississippi, Alabama, Florida, Georgia, South Carolina, and North Carolina. In the Upper Austral it succeeds in northern Arkansas, central and eastern Tennessee, northern Georgia and South Carolina, western North Carolina, Virginia, West Virginia, New Jersey, and Pennsylvania. While grown much more in the Lower than the Upper Austral, the best yields are reported from the latter zone. There is one report from the Transition zone (Ashtabula County, Ohio), where the seed, I think, must be planted for fodder or silage. This variety seems to be adapted to successful growth not far from the boundary between the Upper and Lower Austral zones. (See fig. 1, p. 11.)

(*c*) SOFT CORN.

(13) *Squaw.*—No other Indian corn will mature seed so far north as will this variety. It is reported to have been grown by the Indians, particularly in the Northwest, from times antedating the settlement of the country by the whites. Fifty-two persons reported on it from twelve States and six Canadian provinces, and all of the localities except four are west of the Mississippi River. In the Upper Austral zone it is reported from New Mexico, Nevada, Kansas, Nebraska, South Dakota, Wyoming, Montana, and Idaho. In the Transition it is reported as maturing seed in Flathead, Missoula, and Lewis and Clarke counties, Mont.; in North Dakota and the northern part of South Dakota; in northwestern Minnesota and southern Michigan. In the Canadian provinces it is reported to mature seed at Glencross and Grund, Manitoba; in the Kettle River district, British Columbia; and at Danville, Quebec. Most reports from the Canadian Northwest, Quebec, and Nova Scotia, however, state that it is only grown as garden stuff, and many indicate that it is only raised for green fodder for

live stock. George Martin writes from Saltcoats, eastern Assiniboia, "We are too far north to grow ensilage corn with success." Squaw corn does not mature in Manitoba at Turtle Mountain, Pembina, or Winnipeg, or at Spy Hill, Assiniboia. It is doubtful if it can be depended upon to mature a crop above the Transition, to which zone it properly belongs.

(*d*) SWEET CORN.

(14) *Stowell's Evergreen or Evergreen Sweet.*—Comparatively few notes were received on Sweet or Sugar corn, but as thirty-six persons reported from twenty-eight States, it is thought best to touch upon the distribution of this variety. Sweet corn is essentially successful in the Upper Austral, maturing generally in this zone. No report on Stowell's Evergreen was received from the Transition, except from one point each in northwestern Pennsylvania, southern Wisconsin, northeastern South Dakota, eastern North Dakota, and southern Montana. It was reported from four points in the Lower Austral, in Louisiana, Mississippi, and Alabama. It does not do well, however, in the Lower Austral, and its successful cultivation may be said to be restricted largely to the Upper Austral zone.

(*e*) POP CORN.

(15) *All varieties.*—No one variety of pop corn was specified to any extent by the twenty-five persons reporting from fifteen States and two Canadian provinces. No reports are at hand from the Lower Austral. Nearly all are from the Upper Austral, except the following from the Transition zone: One from Keremeos, British Columbia; one from California; one from Howard, S. Dak.; one from Upper Quebec, and one from Maine. This is really an Upper Austral crop, not coming to its fullest powers in either the Lower Austral or the Transition.

WHEAT.

All of the wheats under consideration belong to the species *Triticum sativum*, and for the purpose of this work may be divided into two groups, winter and spring, as follows:

GROUPS AND VARIETIES.

(*a*) WINTER WHEAT.

(1) Clawson.
(2) Fulcaster.
(3) Fultz.
(4) May.
(5) Mediterranean.
(6) Turkey.
(7) Velvet Chaff.

(*b*) SPRING WHEAT.

(8) Australian.
(9) Ladoga.
(10) Saskatchewan Fife.
(11) Scotch Fife or Fife.
(12) Sonora.
(13) Red Fife.

NOTES ON THE GROUPS AND VARIETIES.

The above-mentioned varieties are shown by the reports to be distributed as follows:

(*a*) WINTER WHEAT.

(1) *Clawson.*—Reports from fifty-five correspondents in nineteen States localize this variety entirely within the Upper Austral and Transition zones. It seems best fitted for the Upper Austral, but thrives also in southern parts of the Transition, in Pennsylvania and Massachusetts. This is due to the wheat having been planted in the upper Ohio and Connecticut River valleys, which traverse the Transition zone.

(2) *Fulcaster.*—Reports from ninety-five correspondents in twenty States limit this variety mainly to the Upper Austral. It is reported, however, from three counties in northern Texas, five in Oklahoma, and one in Mississippi, all in the Lower Austral zone. In Pennsylvania, it touches the Transition, although usually in valleys where Upper Austral conditions prevail.

(3) *Fultz.*—Reports on this variety were received from two hundred and twenty-five correspondents scattered over thirty States. This is the most extensively grown variety of wheat reported on, being raised from the Atlantic almost to the Pacific, and from the Gulf States to those bordering the Great Lakes. Its successful cultivation, however, is mainly restricted to the Upper Austral zone. Here it grows in upper Mississippi and some parts of Alabama, at three points in Texas, seven in Oklahoma, and seven in Tennessee. In the North, at one point in southwestern Wyoming (Evanston), at two in western Montana (Plains and Springhill), at two in Wisconsin, and at a number of points in northeastern Ohio, Pennsylvania, and New York it seems to make successful growth within the Transition zone. Along the Alleghanies, in Tennessee, North Carolina, West Virginia, and Virginia it succeeds in Upper Austral valleys. The general reports of correspondents indicate that it does not find the most successful conditions in the Lower Austral, although, with one exception, reports from Oklahoma are excellent. Fultz really belongs to the Upper Austral and has been grown in many localities in this zone from twenty to thirty years with much success.

(4) *May.*—This variety, or one closely related to it, is also known in some localities by the names of Red May, Little May, Big May, Early May, and Late May. Reports were received from sixty-four correspondents in fourteen States, from points in either the Upper or Lower Austral, usually the latter, but none from localities in the Transition zone. May wheat seems to be grown most extensively in Alabama, Arkansas, Georgia, Kansas, Mississippi, Oklahoma, South Carolina, and Texas. Except in Kansas, two points in south and central Illinois,

one in extreme northwestern New Mexico, and one in the southwest corner of South Dakota, all in the Upper Austral, this variety is best known along the line where the Upper and Lower Austral overlap, apparently favoring the latter zone. It is unquestionably the best known variety which seems at all suited to the higher temperatures of the Lower Austral. (See fig. 2, p. 16.)

(5) *Mediterranean.*—This is one of the oldest and best known varieties of wheat that has been grown in the United States, having been introduced in this country in 1836. It has a long bearded panicle and the grain is amber or red in color. This wheat must not be confounded with Mediterranean Hybrid or any other recently introduced variety with the word Mediterranean forming part of the name. One hundred and three correspondents from twenty-three States reported on it from points almost entirely in the Upper Austral zone. It was reported as growing quite successfully in ten counties in northern Texas and four in southern Oklahoma, which are located in the Lower Austral. It was also noted at one point in California and two in Montana in the Upper Austral, and even reached the Transition at one locality in northeastern Ohio, and one in southern New York. With these exceptions all the reports come from the Upper Austral. (See fig. 2, p. 16.)

(6) *Turkey Red.*—This variety is known under a number of names, as Turkey, Turkey Red, Turkish, etc. Fifty-six correspondents report it grown in Colorado, Illinois, Iowa, Kansas, Missouri, Nebraska, and Oklahoma. The reports show it to be entirely restricted to the Upper Austral zone except along the border of the Lower Austral in southern Oklahoma. This variety is principally raised in Kansas, where it has been grown for fifteen or twenty years, and is still a general favorite.

(7) *Velvet Chaff.*—There are two types of wheat having this name, one being grown somewhat as a spring wheat in the Northwestern States, and the other as a winter variety, mainly in the Central West. This report relates to the winter variety. Velvet Chaff is of four kinds, irrespective of the above distinction. The panicles are divided into two classes, bronze and white, and each of these into two groups, bearded and beardless. A characteristic of each variety, which gives it its name, is the presence of a silvery pubescence on the glumes. No distinction between these four varieties is recognized in considering their geographic distribution. Forty-eight correspondents, representing fourteen States and Oklahoma, and Ontario, Canada, reported on this wheat. It is restricted almost entirely to the Upper Austral, except at one point in the Saginaw region of Michigan in the Transition zone, and three points in southern Oklahoma in the upper portion of the Lower Austral zone. One report from Moscow, Idaho, really comes within the Upper Austral on account of the valley conditions there. Velvet Chaff seems best known in Ohio, Indiana, and Illinois, and is reported to have been grown in Ohio for forty years.

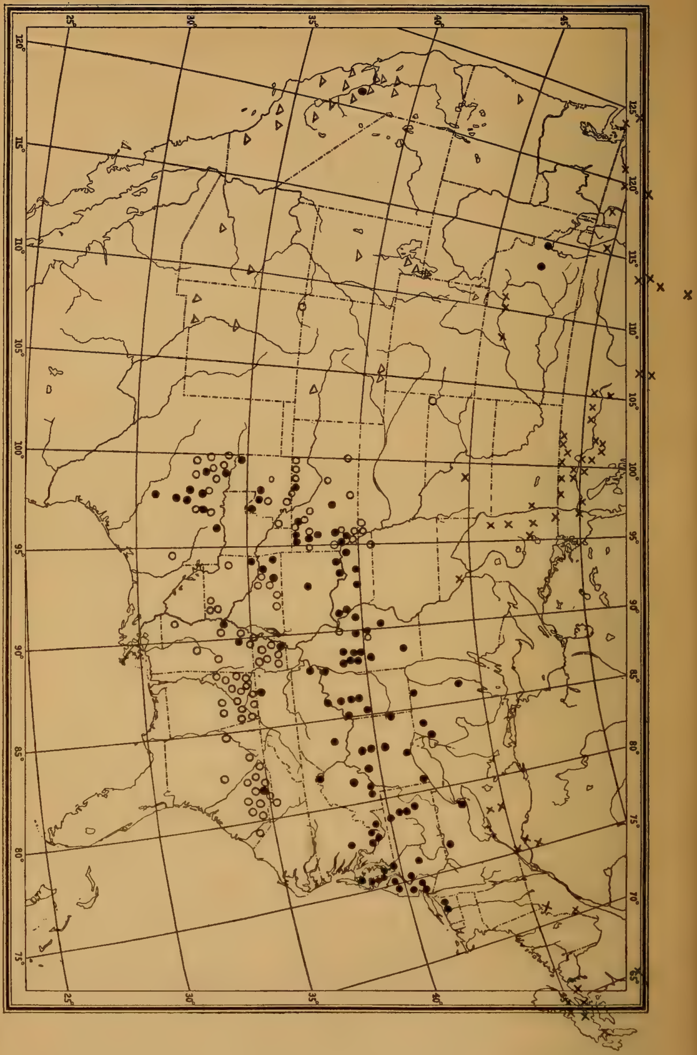
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FIG. 2.—Map showing distribution of four varieties of Wheat: Cross (+)=Red Fife. Spot (●)=Mediterranean. Circle (○)=May. Triangle (△)=Sonora.

(*b*) SPRING WHEAT.

(8) *Australian.*—This is also known as Australian Club and White Australian. It was reported by twenty-eight correspondents as growing in nine States and Territories, and in British Columbia close to the Washington line. It is adapted to the Upper and Lower Austral zones. In California, where it is grown more than elsewhere, it succeeds nicely in the hot San Joaquin and Sacramento valleys, which lie within the Lower Austral. The only report which might seem out of the uniform geographic location is the one at Hazelmere, in Westminster district, British Columbia, which seems to come within the Transition zone. One report from Ohio appears to be a case of a variety improperly named, which really belongs to the winter class.

(9) *Ladoga.*—This variety was introduced from Russia by Prof. William Saunders, of the Central Experimental Farm at Ottawa, Canada, some ten years ago. Its distribution has been entirely in the British provinces. Of thirty-two correspondents only one reports it from the United States (at Bozeman, Mont.), the others being distributed over Alberta, Assiniboia, British Columbia, Manitoba, Saskatchewan, New Brunswick, Nova Scotia, and Ontario. All of these points seem to fall within the Transition, excepting those in British Columbia, Alberta, and Saskatchewan, which latter localities are apparently in the southern part of the Boreal zone. Large yields are reported from these regions, and Mr. C. W. Drayton, at Fort Saskatchewan, reports that it has been known there for eight years, and yields 40 bushels per acre.

(10) *Saskatchewan Fife.*—This is reported from twenty-five points in seven of the Northwestern States and at one point in Alberta. It is grown in greatest amount in North and South Dakota, Minnesota, Nebraska, Wyoming, and Montana, and evidently most successfully in the Transition zone. It is reported from one locality in Alberta (Lewisville), which seems to be within the Boreal.

(11) *Scotch Fife or Fife.*—Correspondents report on this variety at eighty points, mainly in the Transition zone, in Wisconsin, North and South Dakota, Wyoming, Montana, Colorado. Ontario, Quebec, and New Brunswick. It is also reported in southern Manitoba and British Columbia in the Transition, in Alberta at two points in the Boreal, and in Nebraska at four points and Iowa at three points in the Upper Austral. The main evidence, however, shows that it is best suited to the Transition.

(12) *Sonora.*—Twenty-five persons report this variety from the following seven States and Territories: Arizona, California, Colorado, Idaho, New Mexico, Oregon, and Utah. Sonora is one of the commonest varieties of wheat cultivated in California, where it is extensively grown in the Lower Austral. In Arizona, also, it is grown in the Lower Austral, but elsewhere seems to be confined to the Upper Austral. (See fig. 2, p. 16.)

(13) *Red Fife.*—Seventy-three correspondents represent this variety as mainly grown in the British provinces in the Transition zone. It was reported by only seven observers in the United States, two in Minnesota, three in Montana, one in North Dakota, and one in South Dakota. The points in South Dakota and Montana seem to approach the Upper Austral. In British Columbia, Alberta, and Saskatchewan Red Fife seems to do well in the Boreal region. Its most extensive and successful culture, however, is in the Transition zone. (See fig. 2, p. 16.)

OATS.

All of the oats reported upon belong to the species *Avena sativa*, or the common oat. The seven varieties listed may be divided into two general classes, and these into minor groups with individual peculiarities, as follows:

GROUPS AND VARIETIES.

(*a*) OPEN PANICLE OATS.

Long, yellowish-white seed.

(1) American Banner.
(2) Lincoln.

Short, yellowish-white seed.

(3) Welcome.

Long, brownish or dun colored seed.

(4) Burt.
(5) Red Rust Proof.

(*b*) CLOSED PANICLE OATS.

Yellowish white seed.

(6) White Russian.

Brownish or black seed.

(7) Black Tartarian.

NOTES ON THE GROUPS AND VARIETIES.

The above-named varieties are found growing most successfully within certain zones, as shown below:

(*a*) OPEN PANICLE OATS.

(1) *American Banner or Banner.*—One of the best-known varieties grown in the Canadian provinces. Reports were received from eighty persons, seventy-six being from Canada, two from Idaho, one from Washington, and one from Nebraska. The reports from the United States are in the Upper Austral, but from Canada mainly in the Transition zone. There are two exceptions, however; in southern Ontario this oat reaches the Upper Austral, while in Saskatchewan, Alberta, and British Columbia it succeeds in the Boreal zone, 60 and 70 bushels per acre being reported from Fort Saskatchewan and Innisfail, and good yields in the other regions. The notes from western Nebraska are not entirely satisfactory, for while this oat is reported

as succeeding in Lincoln and Logan counties, no yield is given, and it would hardly be expected to do well in this region.

(2) *Lincoln.*—This is one of the most recently introduced varieties, having been before the public some five or six years. It has been widely distributed, and has been received with much favor. Sixty-seven persons reported it from twenty-three States and Territories and from five Canadian provinces, showing it to be very largely grown in the Transition and Upper Austral zones. In the Transition it succeeds in the Dakotas, Minnesota, Wisconsin (about Green Bay), Nova Scotia, New Brunswick, British Columbia, Assiniboia, Manitoba, northern Montana, Ohio (Ashtabula County), and eastern Ontario (Glengary County).

(3) *Welcome.*—One hundred and two persons reported on this variety, from twenty-nine States and eight Canadian provinces. These reports clearly show it to succeed in the Upper Austral and Transition zones, while reports from two points in Alberta, one in Saskatchewan, one in Quebec, and five in New Brunswick and Nova Scotia show that it will produce good crops in the Boreal region. It is commonly grown all over the country north of the Ohio River, in the northern parts of the central and far West. This oat is one of the best known in the United States, and has been sold under the names of White Australian and White Belgian. (See fig. 3, p. 20.)

(4) *Burt.*—This variety is rather locally grown, not being known over a wide territory. Thirty-five persons report it very largely from the Lower Austral zone. It does well generally in Mississippi, Alabama, Georgia, South Carolina, and northern Florida—in Jackson and Leon counties. It grows to some extent in the lower part of the Upper Austral in northern Alabama, Georgia, South Carolina, and middle and eastern Tennessee, and in Washington County, Ind., where the single report shows that it is unsatisfactory as regards yield. It clearly belongs to the Lower Austral zone.

(5) *Red Rust Proof or Texas Red Rust Proof.*—Reports from two hundred and one persons, residing in twenty-two States and Territories, show this oat to be of very wide distribution. It is by far the best-known variety of any grown in the Southern States, and will produce a satisfactory crop when others are completely ruined by the common oat rust. Its yielding powers are satisfactory, so that it has gradually found its way from the Lower to the Upper Austral zone. It is generally grown in Texas and the Southern States, while for a dozen years or so it has been extensively grown in Kansas. It succeeds well in North Carolina, Tennessee, Oklahoma, Arkansas, Missouri, southern Iowa, Illinois, and Indiana. It is also reported as grown in the Upper Austral in California, Oregon, Nevada, Montana, New Mexico, and Maryland. It is certainly well adapted to both the Lower and Upper Austral, especially the former. (See fig. 3, p. 20.)

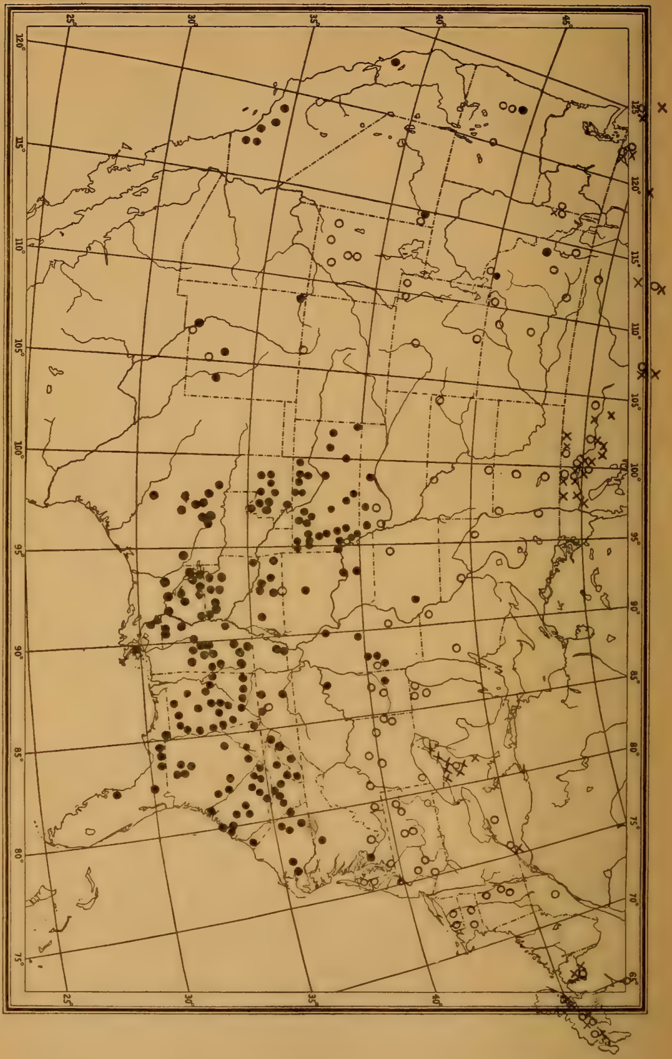
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FIG. 3.—Map showing distribution of three varieties of Oats: Cross (×) = Black Tartarian. Spot (●) = Red-Rust Proof. Circle (○) = Welcome.

(*b*) CLOSED PANICLE OATS.

(6) *White Russian.*—Reports were received from one hundred and eighty-four persons, distributed over thirty-three States and Territories and seven Canadian Provinces. Generally speaking this variety is cultivated almost entirely in the Transition zone, where it reaches its best and most profitable development, the reported yields ranging from 35 up to 100 bushels per acre. It is much more largely grown than all other varieties together in the Northwest, in the Dakotas, Minnesota, Montana, Manitoba, Assiniboia, Alberta, and British Columbia. It is reported as grown to a considerable extent in Michigan, Wisconsin, Nebraska, Wyoming, Utah, Kansas, Colorado, Ontario, New Brunswick, northern New England, West Virginia, northern Indiana, northern Illinois, Ohio, and Oregon. It is also reported from Arizona, New Mexico, Texas, Oklahoma, Louisiana, Arkansas, South Carolina, and Delaware.

Along the border of the Upper Austral and Transition zones this oat does very well, but where reported from the Lower Austral, with the exception of Louisiana, it is not grown with success. The point in Louisiana is in West Carroll Parish, and probably the correspondent names it incorrectly, for from no other point in the Lower Austral have satisfactory reports been received of the growth of the large white varieties of oats. They can not withstand the climatic conditions. Two reports from upper Alberta and seven from New Brunswick and Nova Scotia indicate the successful growth of white Russian oats in the Boreal region; in fact the largest yield reported (100 bushels per acre) is from Nova Scotia, which station, however, probably lies within the Transition zone.

(7) *Black Tartarian.*—Forty-nine correspondents report this variety from Idaho and eight Canadian Provinces. It seems to grow with success in the higher Upper Austral, all through the Transition, and in the Boreal zone. In Ontario it succeeds along the north shore of Lake Erie in the Upper Austral, while in British Columbia, on Vancouver Island, and in Saskatchewan, at Saskatoon and Osler, fair crops are secured. Its most extended cultivation seems to be in eastern Assiniboia, southern Manitoba, and Nova Scotia. It is really best adapted to the Transition zone. (See fig. 3, p. 20.)

DISTRIBUTION OF CEREALS BY ZONES.

The following table shows the distribution by zones of the cereals mentioned in this report:

Distribution of Cereals by Zones.

Zone.	Cereal.	Group.	Variety.
Lower Austral	Corn	Dent	Mosby's Prolific.
	Oats	Open Panicle	Burt.
Border of Upper and Lower Austral.	Corn	Dent	Golden Dent.
	Corn	Dent	Hickory King.
	Corn	Dent	White Gourd Seed.
	Wheat	Winter	May.
	Wheat	Spring	Australian.
	Wheat	Spring	Sonora.
	Oats	Open Panicle	Red Rust Proof.
Upper Austral	Corn	Dent	Bloody Butcher.
	Corn	Dent	Leaming.
	Corn	Dent	St. Charles White.
	Corn	Sweet	Stowell's Evergreen.
	Corn	Pop	All varieties.
	Wheat	Winter	Clawson.
	Wheat	Winter	Fulcaster.
	Wheat	Winter	Fultz.
	Wheat	Winter	Mediterranean.
	Wheat	Winter	Turkey Red.
	Wheat	Winter	Velvet Chaff.
Border of Upper Austral and Transition.	Corn	Flint	Angel of Midnight.
	Corn	Flint	Canadian Eight-rowed Yellow.
	Corn	Flint	King Philip.
	Oats	Open Panicle	Lincoln.
	Oats	Open Panicle	Welcome.
	Oats	Closed Panicle	White Russian.
Transition	Corn	Flint	Longfellow.
	Corn	Soft	Squaw.
	Wheat	Spring	Ladoga.
	Wheat	Spring	Saskatchewan Fife.
	Wheat	Spring	Scotch Fife or Fife.
	Wheat	Spring	Red Fife.
	Oats	Open Panicle	American Banner.
	Oats	Closed Panicle	Black Tartarian.

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Bulletin No. 12.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

LEGISLATION FOR THE PROTECTION OF BIRDS

OTHER THAN GAME BIRDS

BY

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ASSISTANT CHIEF, BIOLOGICAL SURVEY

PREPARED UNDER THE DIRECTION OF
Dr. C. HART MERRIAM
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WASHINGTON
GOVERNMENT PRINTING OFFICE
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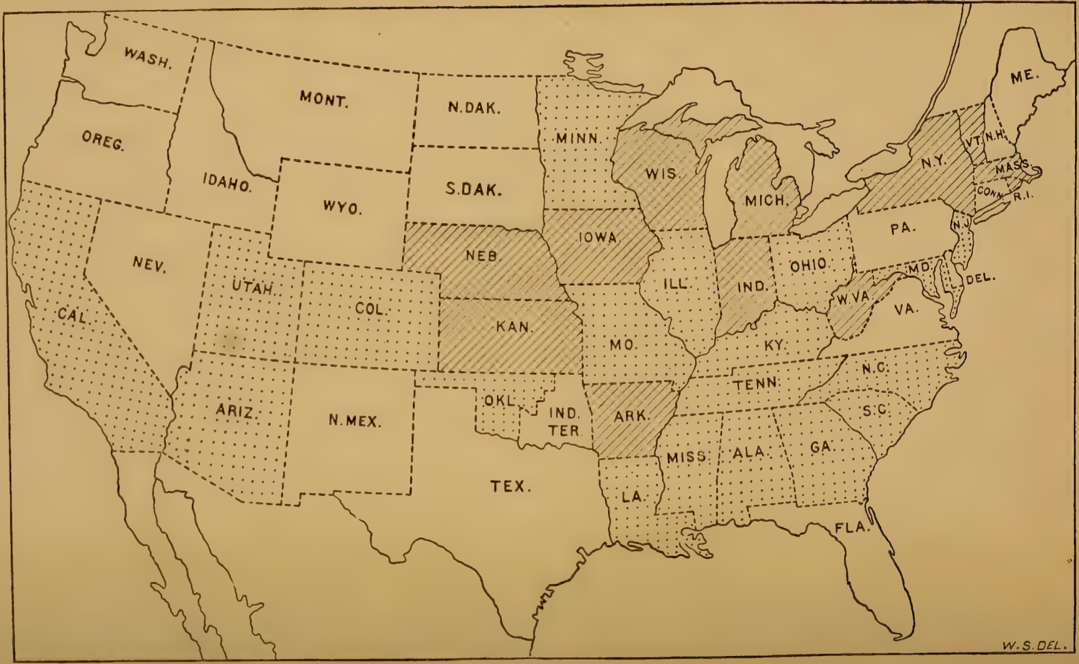
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MAP ILLUSTRATING DIVERSITY IN STATE LAWS FOR THE PROTECTION OF BIRDS.

The Common Dove (*Zenaidura macroura*) is found throughout the United States. In 12 States (shaded) it is protected at all times, in 19 (dotted) only at certain seasons, while in the others it is without protection.

BULLETIN No. 12.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

LEGISLATION FOR THE PROTECTION OF BIRDS

OTHER THAN GAME BIRDS

BY

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1900

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., May 1, 1900.

Sir: I have the honor to submit herewith and to recommend for publication, as Bulletin No. 12 of this Division, a report on Legislation for the Protection of Birds other than Game Birds, by my assistant, Dr. T. S. Palmer. This report has been prepared in response to numerous inquiries in regard to existing regulations for the protection of birds. Its object is to present in convenient form a review of protective legislation, together with the various State laws now in force. The present widespread interest in birds and the importance of calling attention to existing laws in order to render more effective the efforts now being made to protect birds during the breeding season make it desirable that this report be published and distributed as promptly as possible.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

PREFACE.

It is generally admitted that birds which are neither fit for food nor injurious to crops, and more especially species which are insectivorous, are entitled to protection, but the laws enacted for their preservation lack uniformity, and many useful species are not now protected. Fully 90 percent of existing bird legislation has been enacted for the benefit of game birds, which comprise less than 20 percent of all the birds of North America. The other species, which are of special interest to the farmer and the general public, have, until recent years, received scant protection. It is the legislation affecting this large group (more than 80 percent of the species on the Continent) which forms the subject of the present bulletin.

The complicated regulations for the preservation of game birds do not come within the limits of this discussion; hence, such topics as open seasons, swivel guns, night shooting, fire hunting, gun licenses, nonresident licenses, appointment and duties of game wardens, cold-storage traffic, nonexport clauses, and similar matters relating properly to game, receive merely incidental notice. Full information on these questions may be obtained from the laws themselves, or from the very convenient abstract of game legislation published quarterly in 'Game Laws in Brief and Woodcraft Magazine,' which has been freely used in the preparation of this bulletin.

An attempt has been made to bring together in convenient form the various State laws, and in such a compilation it is possible that in spite of all precautions some paragraphs may have been omitted which should have been included, or later amendments than those here given have been overlooked. It is hoped that such omissions will not detract seriously from the value of the work; but any suggestions as to inaccuracies or important additions will be welcomed.

T. S. Palmer.

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LEGISLATION FOR THE PROTECTION OF BIRDS OTHER THAN GAME BIRDS.

I. GENERAL DISCUSSION OF PROTECTIVE LEGISLATION.

INTRODUCTION.

Bird protection in its broadest sense appeals to many persons and diverse interests, and its importance is becoming more generally appreciated. The sportsman who values birds chiefly for the pleasure derived from their pursuit as game, the market hunter who hunts them solely for profit, the farmer who regards them in the light of their relation to agriculture, and the many persons of every class who derive enjoyment from their presence, are all interested in the question of their preservation. The sportsman has long realized the necessity for protective measures, but the farmer has only recently learned to appreciate the full value of birds as insect destroyers. More exact knowledge of their food habits has resulted in a higher estimate of their utility on the farm, and demonstrated more clearly than ever the necessity of active measures to insure their protection. Recent years have also witnessed a greatly increased interest in birds from the æsthetic standpoint, which has resulted in the formation of numerous protective organizations known as Audubon societies. Still bird destruction is going on rapidly in the United States, and in many regions there is a marked decrease in the abundance of certain species. Cheap guns, lax laws, the mania for collecting and shooting, and more especially the enormous demand for birds for market and for the millinery trade, are responsible for this reduction in bird life.

The protection of birds is a national, not a local, question. It deals largely with migratory species which breed in one section, winter in another, and traverse several States in passing to and from their breeding grounds. Legislation on this subject belongs primarily to the States, but if it is to accomplish its purpose in a country like the United States, which, exclusive of Alaska, extends through 24° of latitude and 58° of longitude (an extent equal to two-thirds that of the whole Continent of Europe), there must be greater harmony of action between the several States. Absolute uniformity in the protective laws of fifty distinct Commonwealths may be impossible of attainment, but it is highly necessary, and seems to be feasible, to secure a much greater degree of uniformity than at present exists. State laws may be supplemented to some extent by federal legislation, and a bill has just been passed by Congress to regulate interstate commerce in game killed in violation of local laws. (See page 52.)

Similar, and perhaps greater difficulties exist abroad, but several countries of the Old World, including England, France, Germany, Austria, Italy, Switzerland, Belgium, and even Japan, have taken steps to prevent the indiscriminate slaughter of useful birds. While the limits of this bulletin preclude any account of the regulations that have been adopted in Europe, it is interesting to observe that the importance of uniformity of action between neighboring countries is fully appreciated, as shown by the convention entered into by France and Switzerland in 1885.[1]

Protective legislation was originally intended to secure merely the preservation of birds which were killed for food or sport, but as time went on it was extended gradually to other species. It is this later phase of the subject, the protection of birds not strictly game, which will be discussed here; but before proceeding to the consideration of the laws now in force or the defects in existing legislation, it may be worth while to review very briefly the development of protective laws in the United States.

HISTORY OF PROTECTIVE LEGISLATION.

The necessity of restricting the slaughter of useful birds began to be recognized in the last century, if not before. In 1791 New York enacted a law protecting the heath hen from April 1 to October 5. Some years later, in 1818, Massachusetts passed a law to prevent the wanton destruction at "improper times" of "birds which are useful and profitable to the citizens either as articles of food or instruments in the hands of Providence to destroy many noxious insects, grubs and caterpillars, which are prejudicial or destructive to vegetation, fruits and grain." This law prohibited the killing of quail or partridges between March 1 and September 1, and of woodcock, snipe, larks, or robins from March 1 to July 4. Larks and robins were protected merely as game, and it was not until the middle of the century that birds not usually killed for food received the protection which is now generally accorded them.

In 1850 both Connecticut and New Jersey passed special laws for the protection of insectivorous birds. The New Jersey law, approved March 6, 1850, was entitled "An act to prevent the destruction of small and harmless birds," and is quoted in full, since it is of interest as one of the first of its kind in the United States:

1. *Be it enacted by the Senate and General Assembly of the State of New Jersey*, That it shall not be lawful in this State for any person to shoot, or in any other manner to kill or destroy, except upon his own premises, any of the following description of

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[1] The text of the convention of August 6, 1885, and a brief résumé of protective legislation in Europe may be found in the report of M. de la Sicotière, Congrès International d'Agriculture, 6e section, Protection des Oiseaux, pp. 1-20, Paris, 1889.

birds: The night or musquito hawk, chimney swallow, barn swallow, martin or swift, whippowil [sic], cuckoo, kingbird or bee martin, woodpecker, claip or high hole, catbird, wren, bluebird, meadow lark, brown thrusher [sic], dove, firebird or summer redbird, hanging bird, ground robin or chewink, bobolink or ricebird, robin, snow or chipping bird, sparrow, Carolina lit [sic], warbler, bat, blackbird, blue jay, and the small owl.

2. *And be it enacted,* That every person offending in the premises shall forfeit and pay for each offence the sum of five dollars, to be sued for and recovered in an action of debt by any person who will sue for the same, with cost.

3. *And be it enacted,* That any person wilfully destroying the eggs of any of the above-described birds shall be liable to the penalty prescribed in the second section of this act, to be sued for and recovered as therein prescribed.

Similar acts were passed in 1851 by Vermont, in 1855 by Massachusetts, and shortly after by other States, until in 1864 they were in force in the District of Columbia and twelve States, comprising all of New England, New York, New Jersey, Pennsylvania, Iowa, Michigan, and Minnesota.

These early laws, as exemplified by the New Jersey statute just quoted, enumerated the species to be protected, and extended protection only to 'insectivorous,' 'song,' or 'harmless' birds, as is still done by some of the laws now in force. In 1877, however, Florida went a step further, by enacting special legislation for the preservation of sea birds and plume birds, and in 1891 her example was followed by Texas. Recently a beginning has been made toward preserving birds of prey, or at least discriminating between the useful and injurious species. In 1886 a departure was made by the committee on bird protection of the American Ornithologists' Union, which drafted a bill differing from previous laws by defining game birds and protecting *all others* (with the exception of a few known to be injurious), thus including not only insectivorous and plume birds, but birds of prey as well. (See p. 48.) This method of defining the species to be protected has now been adopted by several States. It has the advantage of clearness, simplicity, and completeness, which is not the case with laws framed on the old lines.

During the last three years a few attempts have been made to legislate against the sale and wearing of feathers of native birds, as the enormous demand for birds for millinery purposes is generally recognized as one of the chief causes of bird destruction. In 1897 California declared that every person who shall at any time kill or have in his possession, "except for the purpose of propagation or for educational or scientific purposes, any English skylark, robin, canary, humming-bird, thrush, or mocking-bird, or *any part of the skin, skins, or plumage thereof,* * * * is guilty of a misdemeanor."[1] In the same year Massachusetts passed a broader law aimed more directly at the trade in feathers, which provided that "whoever has in his possession the body or feathers of any bird whose taking or killing is prohibited by section 4 of chapter 276 of the acts of the year 1886, or wears such feathers for the purpose of dress or ornament, shall be punished [by a fine of $10] as provided in said section."[1] This act was promptly tested in the courts and declared unconstitutional. It was, however, amended by the legislature in the following year, although the new law did not go into effect until April 1, 1899. The words 'whether taken in this Commonwealth or elsewhere' were inserted after '1886,' and another clause was added which excepted from the provisions of the act nonresidents passing through or temporarily dwelling within the State.[2] Maryland also declared in 1898: "No person shall under like penalty [$1 to $5] have in his or her possession, offer for sale or wear, the skins, plumage, wings, or feathers of any of the birds, the catching or killing of which is prohibited by this section."[3] Recently New York has incorporated in its game law a millinery clause, which provides that " no part of the plumage, skin, or body of any bird protected by this section shall be sold or had in possession for sale."[4]

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[1] Penal Code, California, 1897, p. 216.

Federal legislation restricting interstate commerce in birds for millinery purposes has also been advocated, and a bill designed to accomplish that purpose was passed by the Senate at the last session of Congress, but failed to become a law. (See p. 49.)

It has been proposed that, as a means of increasing interest in bird study, the schools observe a special 'Bird Day' each year. This suggestion has met with considerable favor. A 'Bird Day' celebrated with appropriate exercises, similar to and often united with those of Arbor Day, has now become a regular feature of the school calendar in several States, and in some has been recognized by law. Wisconsin in 1897, and Minnesota and Connecticut in 1899, legally established a combined Arbor and Bird Day. (See p. 90.)

It is interesting to notice that protective legislation in America has followed much the same lines as in England. The English law originally protected game only. The birds regarded as such were pheasants, partridges, grouse, heath or moor game, black game, and bustards (1 and 2 Will. IV, c. 32). In 1869 protection was extended to sea birds between April 1 and August 1, and in 1872 to wild fowl between February 15 and August 1. A few years later all birds were protected between March 1 and August 1 by the 'Wild birds protection acts' of 1880–81 (43 and 44 Vict., c. 35; 44 and 45 Vict., c. 51). Finally in 1894 another act was passed enabling the secretary of state, upon application of a county council, to prohibit the taking of eggs of any wild bird either in the county or in certain areas within it.[5]

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[1] Acts of Massachusetts, 1897, chap. 524, p. 561.

[2] Acts of Massachusetts, 1898, chap. 339, p. 275.

[3] Laws of Maryland, 1898, chap. 206, sec. 15H, p. 711.

[4] Laws of 1900, chap. 20, sec. 33.

[5] J. E. Harting, Encyclopædia of Sport, I, p. 447, 1898.

It will be noticed that in one respect there is a wide difference between English and American laws. Under the former all birds are treated alike and are protected only during five months that cover the breeding season, whereas in the United States it is customary to divide birds into two or more categories and protect game birds only during the breeding season, and the other protected species at all times. As will be explained later (see p. 45), only a few States, notably Georgia, North Carolina, and Tennessee, treat all birds alike, but these States really protect few species besides game birds. The English law has the advantage of being more comprehensive than most of our statutes, but the principle of establishing protection only during the breeding season would be open to serious objection in many States on account of the tendency to class a number of insectivorous birds as game. Under that plan such birds would be killed for market in large numbers during the winter months.

DEFINITIONS OF GAME BIRDS.

From the standpoint of the sportsman, birds are either game birds or non-game birds, but from the legislative standpoint they may be roughly divided into three groups: (1) Species which should be protected at all times, as thrushes; (2) species which may be killed at certain seasons for food or sport, as quail; (3) species which are injurious and therefore excluded from protection, as the English sparrow. The first group is usually called 'insectivorous' or 'song' birds, the second 'game,' and the third 'injurious' birds; but these groups are necessarily arbitrary, and their limits are by no means certain. About 1,125 species and subspecies of birds inhabit North America north of Mexico, and of these only about 200 (18 percent) can properly be considered game. (See p. 25.)

As the wording of modern protective laws turns largely on the definition of 'game birds,' it may be well to note some of the different interpretations which have been applied to this term. A game bird, according to the Century Dictionary is "a bird ordinarily pursued for sport or profit, or which is or may be the subject of a game law." Bouvier's Law Dictionary defines game in general as "birds and beasts of a wild nature obtained by fowling and hunting." In different State laws the term is defined in various ways without special regard for uniformity. Thus Maine[1] fixes an annual close season for 'game birds,' and enumerates under this head the wood duck, dusky duck (commonly called black duck), teal, gray duck, ruffed grouse (commonly called partridge), woodcock, quail, plover, snipe, and sandpipers. In the Michigan law[2] the term 'game bird' is construed to mean all birds named or referred to except certain insectivorous species. According to the Code of Mississippi, "the term 'game' includes all kinds of animals and birds found in the state of nature, and commonly so called."[1] Nova Scotia declares: "'Game' shall mean and include * * * Canada and ruffed grouse (commonly called partridge), pheasants, blackcock, capercailzie, ptarmigan, sharp-tailed grouse, woodcock, snipe, bluewinged ducks, teal, and wood ducks."[2] British Columbia decrees that a game bird "shall mean a bird protected by the provisions of this act,"[3] and New Brunswick "any bird mentioned in this act, or of a species or class similar thereto."[4]

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[1] Rev. Stat., chap. 30, sec. 11.

[2] Public Acts, 1897, p. 202, sec. 21.

The plan of enumerating each species, as in some of these laws, is not clear or concise. It also lacks uniformity because of the confusion existing in the common names of certain game birds and the presence of species in one State which do not occur in another.[5]

In order to overcome this difficulty, the Committee on Protection of Birds of the American Ornithologists' Union has suggested using the larger groups called orders and families, into which birds are commonly divided,[6] instead of species, which gives at once a simple and concise definition. "The following only shall be considered game birds: The Anatidæ, commonly known as swans, geese, brant, river and sea ducks; the Rallidæ, commonly known as rails, coots, mud-hens, and gallinules; the Limicolæ, commonly known as shore birds, plovers, surf birds, snipe, woodcock, sandpipers, tatlers, and curlews; the Gallinæ, commonly known as wild turkeys, grouse, prairie chickens, pheasants, partridges, and quail." These four groups, the Anatidæ, Rallidæ, Limicolæ, and Gallinæ, include all the species which are commonly hunted for sport or for food in the United States, with the exception of cranes, wild pigeons, doves, flickers, meadowlarks, reedbirds, blackbirds, and robins. Cranes, pigeons, and doves are ordinarily considered legitimate game, but are now so rare in most States that it has become necessary to remove them from the game list. Flickers, meadowlarks, blackbirds, reedbirds, and robins being insectivorous are more valuable for other purposes than for food, and merit special attention.

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[1] Annotated Code, 1892, sec. 2118.

[2] Laws of 1896, chap. 4, sec. 2.

[3] Statutes, 1898, chap. 24, sec 2.

[4] Acts of 1899, Chap. VIII, sec. 2.

[5] If these species are not mentioned in the game list of the latter State, they can be imported and sold during close seasons, thus furnishing a market for the illegitimate sale of game from other States.

[6] Ornithologists divide the class of birds into orders which are subdivided into groups called families, these again into genera, which in turn are composed of species and subspecies. Only 17 orders and 67 families are represented in North America north of Mexico.

SPECIES ERRONEOUSLY CONSIDERED GAME BIRDS.

PIGEONS AND DOVES.

The order Columbæ, comprising wild pigeons and doves, is represented in the United States by 15 species and subspecies. Of these, only three have any practical importance as game birds, viz, the passenger pigeon (*Ectopistes migratorius*), now almost exterminated; the band-tailed pigeon (*Columba fasciata*), found from the Rocky Mountains to the Pacific coast, and the common, mourning, turtle, or Carolina dove (*Zenaidura macroura*), distributed more or less generally throughout the United States. The wild pigeon is now rarely seen except in two or three of the States about the Great Lakes, where it is rigidly protected.[1] Although it was formerly one of the most important game birds of the country, its numbers have been so diminished during the last thirty or forty years that it can no longer be considered as belonging in the game list. The band-tailed pigeon is an important game bird in only half a dozen States, and Colorado seems to be the only one which provides an open season (July 15 to September 30). The common dove (fig. 1) is protected in some States throughout the year, in others only during the breeding season, while in still others it is not mentioned in the laws, and hence may be killed at any season. (See frontispiece.) Where it is abundant, as in southern California and

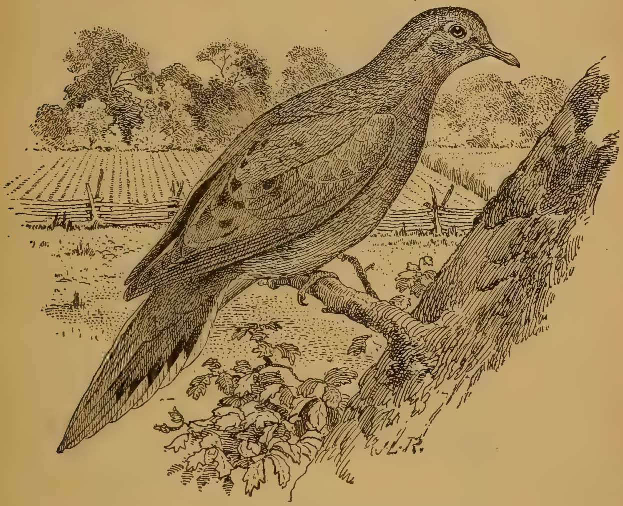

FIG. 1.—Mourning dove (*Zenaidura macroura*).

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[1] The Provinces of Manitoba and Quebec, however, exclude it from the list of protected birds (see pp. 37, 86, 89).

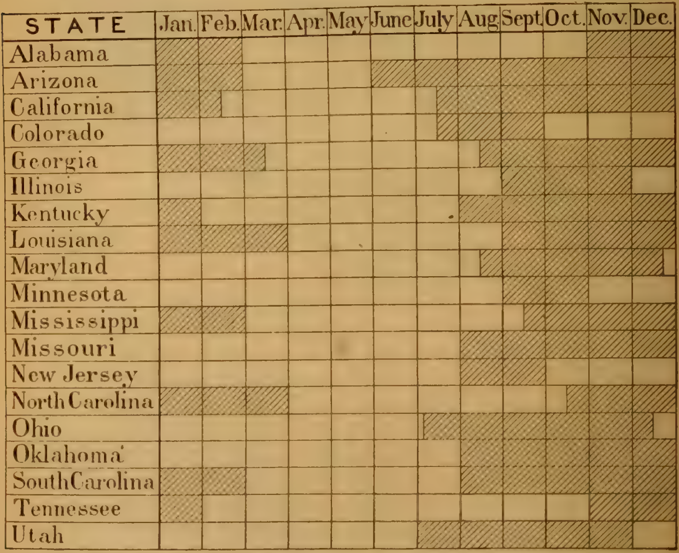
some parts of the Southwest, it is perhaps in no immediate danger of extermination if the slaughter is kept within reasonable bounds. There is, however, a wide diversity in the open seasons in different States. As shown in the following table and diagram, dove shooting is allowed during periods varying from two to nine months. (See fig. 2.)

Open seasons for doves.

State or Territory.	Open season.	State or Territory.	Open season.
Alabama [1]	November 1 to March 1.	Mississippi	September 15 to March 1.
Arizona	June 1 to March 1.	Missouri	August 1 to January 1.
California	July 15 to February 15.	New Jersey	August 1 to September 30.
Colorado	July 15 to September 30.	North Carolina	October 15 to April 1.
Georgia	August 15 to March 15.	Ohio	July 4 to December 15.
Illinois	September 1 to December 1.	Oklahoma	August 1 to December 31.
Kentucky	August 1 to February 1.	South Carolina	August 1 to March 1.
Louisiana	September 1 to April 1.	Tennessee [2]	November 1 to February 1.
Maryland	August 15 to December 24.	Utah	July 1 to December 1.
Minnesota	September 1 to November 1.		

[1] The evident intention was to make the open season August 1 to March 1 (see p. 56).

[2] In Greene and Bradley counties; in Wilson County the open season extends from August 1 to April 1, and in Montgomery and Cheatham counties from August 1 to March 1.



STATE	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Alabama	▨	▨									▨	▨
Arizona	▨	▨				▨	▨	▨	▨	▨	▨	▨
California	▨	▨					▨	▨	▨	▨	▨	▨
Colorado							▨	▨	▨			
Georgia	▨	▨	▨					▨	▨	▨	▨	▨
Illinois									▨	▨	▨	
Kentucky	▨							▨	▨	▨	▨	▨
Louisiana	▨	▨	▨						▨	▨	▨	▨
Maryland								▨	▨	▨	▨	▨
Minnesota									▨	▨		
Mississippi	▨	▨							▨	▨	▨	▨
Missouri								▨	▨	▨	▨	▨
New Jersey								▨	▨			
North Carolina	▨	▨	▨							▨	▨	▨
Ohio							▨	▨	▨	▨	▨	▨
Oklahoma								▨	▨	▨	▨	▨
South Carolina	▨	▨						▨	▨	▨	▨	▨
Tennessee	▨										▨	▨
Utah							▨	▨	▨	▨	▨	

FIG. 2.—Diagram showing open seasons for doves: The shaded area indicates the months when dove shooting is permitted.

Doves feed largely on seeds, and an examination of a considerable number of stomachs has shown that these include seeds of noxious weeds, such as pokeweed and several species of the genera *Lithospermum*, *Oxalis*, and *Euphorbia.* In certain parts of California the habit of feeding on the seeds of turkey mullein (*Eremocarpus setigerus*) is so well known that a botanist, on inquiring how he could collect some seeds of this plant, was advised to shoot a few doves and open their crops. Under some circumstances enormous quantities of weed seed are devoured, as shown by the crop of a dove killed in a rye field at Warner, Tenn., which contained no less than 7,500 seeds of *Oxalis stricta.* As a weed destroyer, the dove more than compensates for the grain which it occasionally consumes, and the value of its services is certainly greater than the few cents which its body brings in market.

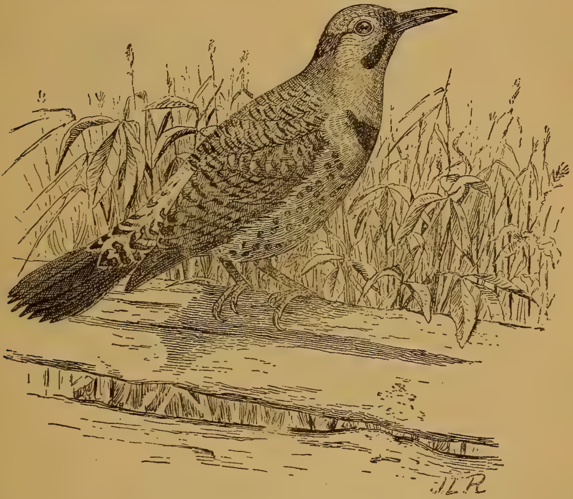


Fig. 3.—Flicker (*Colaptes auratus*).

FLICKERS.

Of the woodpeckers, the flickers or pigeon woodpeckers (fig. 3), represented in the East by the yellow-shafted flicker (*Colaptes auratus*) and in the West by the red-shafted flicker (*C. cafer*), are the only ones which are killed to any extent for food.[1] They are still regarded as legitimate game in some sections, but apparently are so treated by law only in Nevada, which fixes an open season from September 15 to March 15. Like other woodpeckers, the flicker is mainly insectivorous. An examination of 230 stomachs of the yellow-shafted flicker showed the presence of 5 percent mineral, 39 percent vegetable, and 56 percent animal matter.[1] The mineral element was mainly sand, probably picked up accidentally along with other food. The vegetable matter consisted of the seeds of a number of weeds and berries of several native shrubs and occasionally a small amount of grain, but too little to be of much consequence. Flickers are more terrestrial than other woodpeckers, and a large part of their animal food consists of ants, which constitute nearly half the food of the year. Several stomachs contained little else, and at least two contained more than 3,000 each of these insects. Beetles stand next to ants in importance, forming about 10 percent of the food, and including chiefly May beetles, a few snapping beetles, and carabids, or predaceous ground beetles. Grasshoppers also are eaten at certain times, as shown by several stomachs (collected in June, 1865, in Dixon County, Nebr.), which contained from 15 to 48 grasshoppers each. A bird with such a record is far too valuable to be killed for food, and is entitled to all the protection ordinarily accorded insectivorous species.

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[1] In some parts of the South the pileated woodpecker (*Ceophlœus pileatus*) is sold as game, and a few specimens can be found occasionally in the markets of Washington, D. C.

BOBOLINKS OR REEDBIRDS.

Comparatively few passerine birds are treated as game. Among these few, bobolinks (reedbirds), blackbirds, meadowlarks, and robins are the most important. The enormous numbers of bobolinks (*Dolichonyx oryzivorus*—fig. 4) which flock to the Atlantic coast each autumn to feed on the seeds of wild rice before taking their departure for the rice fields of the South and their winter haunts in South America have given rise to the sport of reedbird shooting, a sport scarcely known in other sections of the country. The bobolink, which is rigidly protected during its stay on its breeding grounds in the Northern States, receives the name of reedbird as soon as it enters the Middle States in autumn dress, and is considered legitimate game. Open seasons are legalized in the Middle States as follows: Delaware, September 1 to February 1; District of Columbia, August 21 to February 1 (Tuesdays, Thursdays, and Saturdays only); Maryland, September 1 to November 1; New Jersey, August 25 to January 1; Pennsylvania, September 1 to November 30. For a few weeks it is killed in enormous numbers for market, and when it reaches the Carolinas, farther south, where it is known as the ricebird, the slaughter is increased, not for sport, but as protection against its ravages in the rice fields. Here it becomes a veritable pest, and may be killed lawfully at any season. To many persons it is a delicious morsel, although its diminutive body furnishes little more than a taste of meat. There would be no objection to utilizing the bird for food were it not for the abuse to which this custom of killing it for market has given rise. Not only are other birds killed for reedbirds, but in States in which reedbirds do not occur marketmen try to make up the deficiency by furnishing various small birds under that name. In the markets of San Francisco horned larks (*Otocoris*), red-winged blackbirds (*Agelaius*), Brewer's blackbirds (*Scolecophagus*), white-crowned and golden-crowned sparrows (*Zonotrichia*), song sparrows (*Melospiza*), savanna sparrows (*Ammodramus*), house finches (*Carpodacus*), and even goldfinches (*Astragalinus*), have all been sold as reedbirds.[1] Such conditions serve only to defeat the object of protective laws, and for this reason, if for no other, reedbirds should be taken off the game list, except in the few States in which they are known to be abundant; and even here their sale should be carefully regulated to prevent the slaughter of robins, larks, and other birds, which are almost certain to be killed by market hunters.

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[1] Beal, Food of Woodpeckers, Bull. 7, Div. Ornith. and Mamm., Dept. Agr., pp. 16–20, 1895.

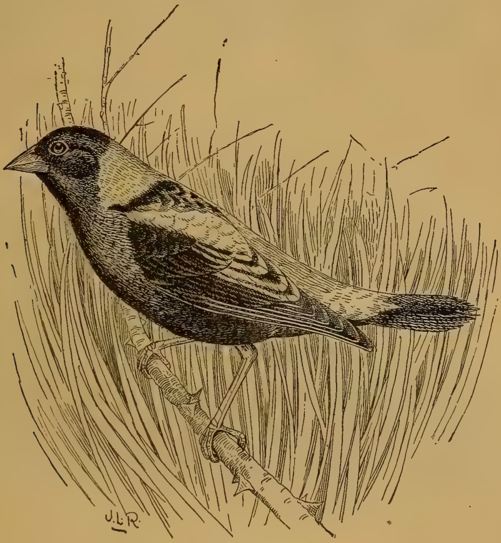

FIG. 4.—Bobolink (*Dolichonyx oryzivorus*).

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[1] Bryant, Zoe, II, pp. 142–145, 1891.

MEADOWLARKS.

Like the flicker, the meadowlark (*Sturnella magna*—fig. 5) is considered game by many persons, mainly on account of the character of its meat, which in some respects resembles that of quail. A few States provide an open season for lark shooting, as follows: Mississippi, September 15 to March 1; Missouri, August 1 to January 1; North Carolina, October 15 to April 1; British Columbia, September 1 to March 1; Georgia apparently allows the bird to be killed at any season. Its importance to sportsmen is small in comparison with its value to farmers. Professor Beal, in speaking of its food habits says: "It is one of the most useful allies to agriculture, standing almost without a peer as a destroyer of noxious insects. * * *

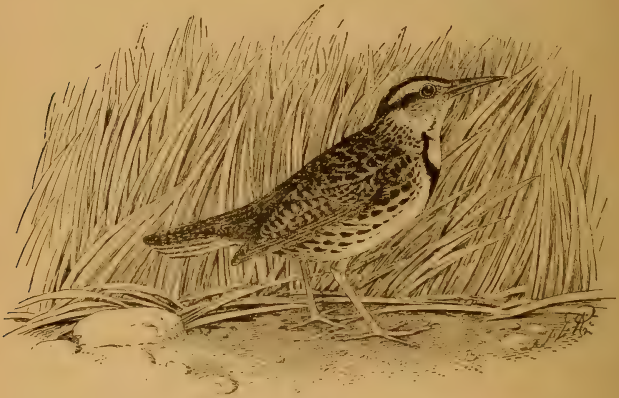

Fig. 5.—Meadowlark (*Sturnella magna*).

In summing up the record of the meadowlark, two points should be especially noted: (1) The bird is most emphatically an insect eater, evidently preferring insects above all other food; and (2) in default of its favorite food it can subsist on a vegetable diet."[1]

Professor Beal made an examination of 238 stomachs, and reported that the contents comprised about 27 percent vegetable matter and 73 percent animal matter. In other words, nearly three-fourths of the food of the meadowlark for the year, including the winter months, consists of insects. The vegetable food comprises mainly seeds of weeds, grasses, and a little grain, but the grain, chiefly corn, amounted to only 14 percent. No sprouting corn was found in any stomach, and no grain of any kind was found in stomachs taken in summer; the largest quantity was eaten in January, when other food was scarce.

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[1] Yearbook Dept. Agr., 1895, pp. 420 and 426.

Among the insects taken at various times during the year, grasshoppers, locusts, and crickets are by far the most important, since they averaged 29 percent of the food. Of the 238 stomachs examined, 178 contained grasshoppers, and 37 of these insects were found in a single stomach. In August stomachs they constituted 69 percent of the food. Beetles, which stand next in importance to grasshoppers, included chiefly May beetles (Scarabæidæ), snout-beetles or weevils (Rhyncophora), and leaf-beetles (Chrysomelidæ). Caterpillars formed an important element of the food, and ants a small, but fairly constant, item, about 3 percent for the year.

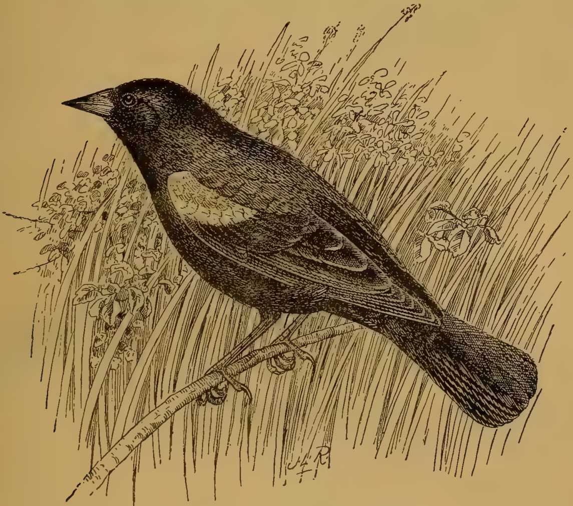

FIG. 6.—Red-winged blackbird (*Agelaius phœniceus*)

BLACKBIRDS.

In the District of Columbia red-winged, or marsh, blackbirds (*Agelaius phœniceus*—fig. 6) are treated as game birds and an open season for shooting them is set apart. The argument is made that on account of the damage they do to grainfields, particularly in the spring and autumn, blackbirds may be kept from becoming too abundant by treating them as game. But it may well be questioned whether this would reduce their numbers as effectually as if they were excluded entirely from protection in localities where they are injurious. Game birds are necessarily protected for a longer or shorter time during the breeding season, while species excepted from protection may be killed at any season. A full account of the food habits of the various blackbirds may be found in Bulletin No. 13 of the Biological Survey.

ROBINS.

In some sections of the South, particularly in New Orleans, all kinds of small birds, even thrushes, are considered legitimate game, and are offered for sale in the markets. According to Prof. H. Nehrling, "one main cause of the fearful decrease of our small migratory birds must be looked for in our Southern States. There, millions of all kinds of birds are killed to satisfy the palate of the gourmand. * * * There is scarcely a hotel in New Orleans where small birds do not form an item on the bill of fare. At certain seasons the robin, wood thrush, thrasher, olive-backed thrush, hermit thrush, chewink, flicker, and many of our beautiful sparrows form the bulk of these victims; but cat-birds, cardinals, and almost all small birds, *even swallows*, can be found in the markets."[1] Mr. Andrew Allison, of New Orleans, gives similar testimony: "In the fall migrations, when all the migrants are literal butter-balls, appalling numbers of cat-birds, wood thrushes, red-eyed vireos, king birds, tanagers, and in fact any easily-shot birds are killed * * * near the coast towns. Wood thrushes and cat-birds are more persecuted than any other, under the name of *grassé*, and many are sent to the markets here in September and October."[1]

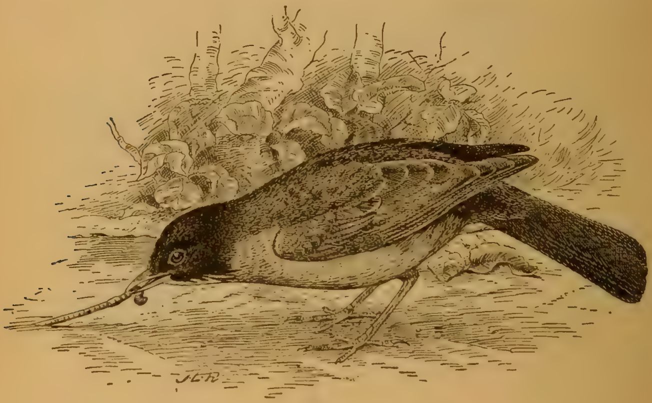

FIG. 7.—Robin (*Merula migratoria*).

Robins (*Merula migratoria*—fig. 7) are perhaps more generally killed than any of the other thrushes, and in some States their killing is legalized at certain seasons—for example, in North Carolina, from October 15 to April 1. A few years ago large numbers of robins were shipped to the markets of Washington, D. C., from various points in Virginia and North Carolina. In the spring of 1897 no less than 2,700 were received in one lot. These birds were killed near roosts just before the northward migration set in; fortunately their sale could be stopped in the District of Columbia, but their killing at this season was lawful in North Carolina.

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[1] See W. T. Hornaday, 2d Ann. Rept. N. Y. Zool. Soc., p. 86, 1898.

It seems hardly necessary to call attention to the insectivorous habits of robins; but a few details may add emphasis. In an examination of 330 stomachs,[1] 42 percent of the food was found to consist of animal matter, chiefly insects, while the remainder was made up largely of small fruits or berries. Grasshoppers, caterpillars, and beetles composed the principal part of the insect food, grasshoppers forming nearly 30 percent of the total food in the month of August. The vegetable element, 58 percent, was largely composed of wild fruits, which had been eaten in nearly every month. Cultivated fruit was found in small amounts, chiefly in stomachs collected in June and July, but the depredations of the birds seemed to be confined mainly to smaller and earlier fruits, and as Professor Beal has shown, the damage thus done may be obviated by planting wild fruits, which the birds prefer to cultivated varieties.

INSECTIVOROUS AND SONG BIRDS.

An examination of the various State laws shows that definitions of non-game birds accorded protection are in most cases very loose. The matter of definition is a difficult one in view of the fact that the number of birds now recognized in North America is over 1,100, and that the list of even so small a State as Rhode Island (with an area of only about 1,000 square miles) contains no less than 291[2] species, while 374 species are known to occur in Colorado[3] and 415 in Nebraska.[4]

Attempts are often made to name the more important birds (as in the case of the Alabama law, which enumerates 50 species), but it is obviously impracticable to name all, and the common practice is to mention a few and to include the others under such general terms as 'insectivorous,' 'song,' or 'useful' birds. Georgia depends entirely on the term 'insectivorous or song birds' and Missouri likewise prohibits the killing of 'any wild song bird or insectivorous bird,' without mentioning species. Other States extend their lists of protected species by the terms 'other harmless birds' (Iowa, Minnesota, and Wisconsin), 'any other of the small birds known as singing birds'

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[1] Beal, Farmers' Bulletin 54, p. 38, 1897.

[2] Howe and Sturtevant, Birds of Rhode Island, 1899. This number does not include the introduced English sparrow.

[3] Cooke, Bull. 44, Colo. Agr. Expt. Station, p. 150, 1898.

[4] Bruner, Some Notes on Nebraska Birds, p. 49, 1896.

(Montana), 'any other bird whose habits are not essentially predatory upon and destructive of the agricultural products of man' (West Virginia), 'birds of like nature that promote agriculture and horticulture by feeding on noxious worms and insects, or that are attractive in appearance or cheerful in song' (Nebraska). Only one State, South Carolina, distinctly limits the term to 'any bird whose *principal* food is insects.'

Probably less than two-thirds of the North American birds are, strictly speaking, insectivorous, and a much smaller proportion are properly song birds. Beside the four orders of perching birds (Passeres), swifts and hummingbirds (Macrochires), woodpeckers (Pici), and cuckoos (Coccyges), which comprise a little more than 600 species, few groups contain many species which can be considered insectivorous. Even a liberal interpretation of the term excludes more than one-third of the birds unless they are protected by some additional clause, such as 'plume birds,' which is adopted in the Florida statute to cover herons, ibises, cranes, and curlews.

In the report of the New Jersey Fish and Game Commission for 1899, some objections to the indefinite term 'insectivorous' are stated as follows:

> The question naturally arises as to what constitutes an insectivorous bird. Is a bird to be regarded as insectivorous which feeds on insects for two or three weeks every year? Under the provisions of the present law persons might be prosecuted for killing shore birds, for these feed to a great extent on aquatic insects, and the prosecution against a person for having killed reedbirds during the open season would result in a conviction, for the reedbirds destroy insects in large numbers, and the prohibition of the law against killing insectivorous birds is certainly sweeping.[1]

Although this is doubtless an extreme, if not erroneous, interpretation of the phrase, it shows the objection to the use of this term unless qualified in some such way as in the South Carolina statute. But the chief objection is that the definition is vague and instead of going too far, does not *go far enough*, and thus fails to cover a large number of birds which are as worthy of protection as those which depend mainly on insects for food.

Inasmuch as game birds constitute but a small proportion of the avifauna of any State, it seems more reasonable to enumerate them and extend protection to *all others*, as is now the practice in some States (see pp. 63, 67, 82). This may be done quite briefly by following the groups or families and orders into which ornithologists combine various species. Of the 17 orders of North American birds shown in the table on page 25, only 4 (marked with an asterisk) include true game birds and but 4 others species which are properly insectivorous, so that by defining game birds, as suggested by the American Ornithologists'

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[1] See Forest and Stream, LIV, pp. 9-10, January 6, 1900.

Union, the statement regarding the protection of the others may be reduced to a few words, as follows: *Any wild bird, other than a game bird*, excepting the English sparrow (and such other species as may be considered injurious).

Orders of North American birds.

[The orders marked with an asterisk (*) are the only ones which include game birds proper.]

Order.	Birds.	Species and subspecies.[1]
Pygopodes	Grebes, loons, and auks	37
Longipennes	Jaegers, gulls, and terns	50
Tubinares	Albatrosses, shearwaters, and petrels	41
Steganopodes	Gannets, cormorants, and pelicans	24
*Anseres (Anatidæ)	Ducks, geese, and swans	64
Odontoglossæ	Flamingos	1
Herodiones	Herons, bitterns, ibises, etc	24
*Paludicolæ[2]	Cranes, rails, and coots	22
*Limicolæ	Shore birds	76
*Gallinæ	Pheasants, grouse, and quail	45
Columbæ	Pigeons and doves	15
Raptores	Birds of prey: Buzzards, hawks, and owls	94
Psittaci	Parrots	1
Coccyges	Cuckoos, anis, and kingfishers	13
Pici	Woodpeckers	43
Macrochires	Goatsuckers, swifts, and hummingbirds	34
Passeres	Perching birds	540
Total		1,124

[1] Corrected to include the ninth supplement of the American Ornithologists' Union Check List, 1899.

[2] Comprises three families, Gruidæ, Aramidæ, and Rallidæ, of which only the last (containing 18 of the 22 species and subspecies) is included in the list of game birds.

PLUME BIRDS.

The general term 'plume birds' is here used to include not only the herons, which are killed for their nuptial plumes, but a number of water birds which are used for decorative purposes, such as pelicans, terns, gulls, and grebes. The snowy heron furnishes the well-known aigrettes; pelicans supply quills and breasts; gulls and terns are worn in great numbers on hats; while grebes' breasts, besides being used for trimming hats, are also made into muffs, collarettes, and capes. There is an enormous demand for plume birds by the millinery trade in years when they are in fashion, and the localities where the birds breed are scoured by hunters, who find a ready market for the skins at prices varying from 10 to 50 cents apiece.[1] As these birds all nest in colonies, it is a simple matter to destroy large numbers on the breeding grounds; and so thoroughly is the work done that some of the species, particularly the egrets and terns, have been almost exterminated along the southern and eastern coasts of the United States.[1]

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[1] Bird Lore, II, p. 66, April, 1900.

The value of herons, terns, and grebes is not generally appreciated, and even the services of the gulls as scavengers are recognized in comparatively few places. As a result, birds of plume being neither game, song, nor 'insectivorous,' are not protected by ordinary game laws unless by chance they happen to be mentioned in the list of protected species. Thus, by a curious perversity of circumstances, the species which are killed most mercilessly and in the greatest numbers are the very ones which are accorded the least protection.

Plume birds as well as insectivorous birds are protected in States which have comprehensive laws prohibiting the killing of all birds except game birds and certain designated species commonly considered injurious. But these States are few in number, and include only Arkansas, Illinois, Indiana, Massachusetts,[2] New York,[3] Rhode Island, and Vermont and also the Provinces of Manitoba and Ontario.

The only States that have special legislation for plume birds are Florida and Texas. In her law of 1877, Florida prohibited the destruction of nests, eggs, or young of any sea bird or bird of plume under a fine not exceding $20; two years later she made the killing of any 'birds for the purpose of obtaining plumes' by persons who were not citizens of the United States a crime punishable by a fine of not more than $100. Later, in 1891, the killing of cranes, egrets, ibises, curlews, or herons for purposes of sale, or the purchasing or trading in such birds, was made a misdemeanor punishable by a fine not exceeding $300.[4] The plume-bird law of Texas, enacted April 13, 1891, declares the killing of sea gulls, terns, shearwaters, egrets, herons, and pelicans a misdemeanor, punishable by a fine of from $5 to $25.[5]

In addition to these two States, Maine has recently enacted a special law protecting terns; Maryland protects both gulls and terns; New Jersey and Pennsylvania protect these and similar birds under the term 'web-footed wild fowl;' Michigan, under the term 'wild water-fowl;' Minnesota and Wisconsin, under 'aquatic fowl;' while Michigan,

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[1] For an account of the slaughter of herons in the South, see Scott, Auk, IV, pp. 135, 213, 273, 1887; Chapman, Handbook Birds East. N. Am., p. 134, 1895. On the extermination of terns, see Chapman, ibid., p. 82; Bird Lore, I, pp. 205–206, December, 1899. On the destruction of grebes, see Bailey, Bird Lore, II, p. 34, February, 1900.

[2] In Massachusetts exceptions are made in the case of gulls and terns, which are protected only from May to September, inclusive.

[3] In New York the protection of gulls and terns is practically reduced to four months by the clause which prohibits the killing of 'web-footed wild fowl' only between the last day of April and the last day of August; exceptions are also made in the case of grebes and bitterns, which are protected only during the same period.

[4] Rev. Stat., 1892, secs. 2755–2756; Appendix, chap. 4050.

[5] Rev. Stat., 1895, Penal Code, p. 100.

Oregon, Utah, and Virginia include gulls in the list of protected species. The scope of these laws may be illustrated by the following table:

Plume birds protected in various States.

[The × indicates the bird to which the State law applies.]

States.	Grebes.	Gulls.	Terns.	Pelicans.	Egrets.	Remarks.
Arkansas	×	×	×	×	×	Wild birds.[1]
California	....	×	....	....	....	Local acts for Santa Monica and Santa Barbara County, and about San Francisco Bay.
Florida[2]	....	....	....	....	×	
Illinois	×	×	×	×	×	Wild birds.
Indiana	×	×	×	×	×	Do.
Maine	....	....	×	....	....	
Maryland	....	×	×	....	....	
Massachusetts	×	×	×	×	×	Gulls and terns only 5 months.
Michigan	×	×	×	×	....	Gulls specifically and the others under wild waterfowl.
Minnesota	×	×	×	×	....	Aquatic fowl for 8 months.
New Jersey	....	×	×	×	....	Web-footed wild fowl for 4 months.
New York	×	×	×	×	×	Grebes and web-footed wild fowl for 4 months.
Oregon	....	×	....	....	....	
Pennsylvania	....	×	×	×	....	Web-footed wild fowl for 4 months.
Rhode Island	×	×	×	×	×	Wild birds.
Texas	....	×	×	×	×	
Utah	....	×	....	....	....	
Vermont	×	×	×	×	×	Do.
Virginia	....	×	....	....	....	Protected until September 1.
Wisconsin	×	×	×	×	....	Aquatic fowl for 8 months.

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[1] The term 'wild birds' indicates that the law prohibits the killing of *any wild birds* other than game birds and certain excepted species, thus including birds of plume.

[2] No plume birds can be killed by persons who are not citizens of the United States.

In the absence of State laws, protective legislation is occasionally secured through county boards of supervisors, which have authority in some States to make ordinances covering such matters. Thus, in California, although the State passed a special act prohibiting the killing of gulls near Santa Monica, Los Angeles County, it has no general law protecting these birds. Santa Barbara County, however, passed a special ordinance on October 3, 1899, prohibiting the killing of eagles, gulls, terns, and pelicans, which should effectually protect these birds within the limits of this county. Gulls are also protected in a few other localities, as about San Francisco Bay.

A few States have more comprehensive laws for the protection of nests and eggs than for birds. Thus, Florida protects only cranes, egrets, ibises, curlews, and herons, but forbids the destruction of the nest, eggs, or young of *any sea birds* or birds of plume. Maine protects no plume birds except terns, but forbids the destruction of the nests, eggs, or young of 'any wild bird,' with certain exceptions, thus protecting the young of gulls and grebes as well as terns. Delaware, Kentucky, and Louisiana likewise, which make no effort to protect plume birds, have similar laws prohibiting the destruction of nests or eggs of 'any wild bird,' and thus extend protection to the nests of grebes, gulls, and terns.

The following list of references has been prepared to facilitate consultation of the various State laws relating to plume birds:

Arkansas: Acts, 1897, XLI, sec. 1, p. 53 (wild birds).

California: Penal Code, 1897, p. 563, sec. 1 (gulls at Santa Monica).

Delaware: Rev. Stat., 1893, Ch. LV, sec. 6 (nests or eggs of any bird).

Florida: Rev. Stat., 1892, p. 847, sec. 2755 (nests, eggs, or young of sea birds or birds of plume); p. 992, sec. 1 (cranes, egrets, ibises, curlews, and herons).

Illinois: Laws, 1899, p. 224, sec. 3 (wild birds).

Indiana: Thornton's Rev. Stat., 1897, sec. 2243 (wild birds).

Kentucky: Statutes, 1894, sec. 1948 (nests or eggs of any wild bird).

Louisiana: Rev. Laws, 1897, p. 247, sec. 5 (nests or eggs of any wild bird).

Maine: Pub. Laws, 1899, ch. 42, sec. 12, p. 35 (nest, eggs, or young of any wild bird[1]); ch. 116, p. 119 (terns).

Maryland: Laws, 1898, ch. 206, sec. 15H. (gulls and terns [mackerel gulls]).

Massachusetts: Supplement Pub. Stat., 1888, ch. 276, secs. 2 and 4 (wild birds).

Michigan: Pub. Acts, 1897, p. 202, sec. 20 (gulls).

Minnesota: Laws, 1899, ch. 242, sec. 10, p. 275.

New Jersey: Gen. Pub. Laws, 1895, Ch. CCLV, sec. 8, p. 476 (nest or eggs of *any* wild bird); Laws, 1900, ch. 73, sec. 5 (web-footed wild fowl).

New York: Laws, 1900, ch. 20, sec. 20 (web-footed wild fowl); sec. 30 (grebes).

Oregon: Gen. Laws, 1895, p. 97, sec. 27 (gulls).

Pennsylvania: Act of May 17, 1883, sec. 1 (web-footed wild fowl).

Rhode Island: Laws, 1900, ch. 746, sec. 2 (wild birds).

Texas: Rev. Stat., 1895, Penal Code, art. 519, p. 100 (sea gulls, terns, shearwaters, egrets, herons, and pelicans).

Utah: Laws, 1899, ch. 26, sec. 22, p. 42 (gulls).

Vermont: Stat., 1894, p. 829, sec. 4614 (wild birds).

Virginia: Code, 1887, p. 520, sec. 2079 (gulls or 'strikers').

Wisconsin: Acts, 1899, ch. 267, sec. 1 (any aquatic fowl except geese).

BIRDS OF PREY.

In view of the widespread prejudice against birds of prey, it is perhaps not surprising that comparatively little protection is given them. Only a few years ago several States endeavored to exterminate hawks and owls by means of bounties,[2] and although most of the bounties have been withdrawn, protection is still withheld even in States which have the most comprehensive laws. The list of species exempt from protection on pages 36–37 indicates how generally hawks and owls are still held in disfavor.

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[1] Except herons, etc. (see p. 66).

[2] For a brief review of bounty legislation in the United States, see Palmer, Yearbook Dept. Agr., 1896, pp. 58–59; Yearbook Dept. Agr., 1899, pp. 279–282.

A hasty examination of the various State laws will show that the tide of popular prejudice has, however, begun to turn, and some effort is now being made to distinguish the useful from the injurious birds of prey. Nine States and the District of Columbia protect turkey buzzards, three States forbid the killing of eagles, one protects fish hawks, while one prohibits the killing of any hawks or owls. In addition, buzzards, owls, and certain hawks are included by implication in the list of species protected in Illinois, Minnesota, and New York.

It is somewhat surprising that the value of turkey buzzards is not more generally recognized. They are specifically protected in Maryland, the District of Columbia, Virginia, West Virginia, South Carolina, Texas, Oklahoma, Colorado, and Wyoming, but protection should be accorded them by all the States in the South and Southwest as well as the Territories of Arizona and New Mexico. According to Chapman,[1] "their services as scavengers are invaluable." The work of these birds at Charleston, S. C., is well known, and the high estimation in which they are there held is shown by the fact that a fine of $10 apiece is imposed for killing them. The penalty in Texas ranges from $5 to $15, but about one-fourth of the counties in the State are exempt from the operation of the law. The term 'turkey buzzard' includes not only the true turkey buzzard (*Cathartes aura*), but also the black vulture or carrion crow (*Catharista urubu*), which is found in the South Atlantic and Gulf States, where the two species often associate together. The laws of Texas and Virginia are apparently the only ones which distinguish the two species and mention, the one, the 'carrion crow' and, the other, the 'black buzzard' in addition to the turkey buzzard.

The protection of eagles is probably based on sentimental rather than economic grounds, and is inspired by a desire to insure against extermination the bird which has been adopted as the national emblem. Ohio includes eagles in its list of protected species and Connecticut protects them by a special law, while New Hampshire has prohibited the killing of any bald eagles before 1902 under a penalty of $40.

In the protection of hawks and owls nearly all the States are noticeably conservative, and few mention these birds in the list of protected species. Illinois extends protection to all birds with the exception of 'chicken hawks' and a few other species, New York to 'wild birds' except hawks and a few others, and Minnesota to 'harmless birds' except hawks, crows, blackbirds, and English sparrows. Rhode Island extends protection to fish hawks, while Utah is the only State which goes so far as to protect all hawks and owls.

In reality, so far from being injurious, the great majority of the birds of prey in the United States are decidedly beneficial. Of the 90 species which occur north of Mexico, about 17 consist of stragglers or of subspecies of little importance from an economic standpoint. Of the 73 important species and subspecies, only 6 have been shown to be actually injurious, viz, the sharp-shinned hawk (*Accipiter velox*), Cooper's hawk (*Accipiter cooperi*), goshawk (*Accipiter atricapillus*), duck hawk (*Falco peregrinus anatum*), pigeon hawk (*Falco columbarius*), and great horned owl (*Bubo virginianus*).[1] On the other hand, some of the species are decidedly useful as insect destroyers. Two of the large hawks commonly included under the term 'chicken hawk'—Swainson's hawk (*Buteo swainsoni*) and the red-shouldered hawk (*Buteo lineatus*)—feed largely on insects, and the former bird destroys immense numbers of grasshoppers when such food is available. In an examination of 18 stomachs of Swainson's hawk, 8 were found to contain insects, and no poultry or birds were found in any; while of 220 stomachs of the red-shouldered hawk, 92 contained insects and only 15 poultry or birds. A still more striking example of grasshopper-eating proclivities is that of the sparrow hawk—one of our most useful birds. In referring to this species, Dr. Fisher says:

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[1] Birds Eastern N. Am., p. 192, 1895.

> The subject of the food of this hawk is one of great interest, and considered in its economic bearings, is one that should be carefully studied. The sparrow hawk is almost exclusively insectivorous, except when insect food is difficult to obtain. In localities where grasshoppers and crickets are abundant these hawks congregate, often in moderate-sized flocks, and gorge themselves continuously. Rarely do they touch any other form of food until, either by the advancing season or other natural causes, the grasshopper crop is so lessened that their hunger can not be appeased without undue exertion. Then other kinds of insects and other forms of life contribute to their fare. Beetles, spiders, mice, shrews, small snakes, lizards, or even birds may be required to bring up the balance.[2]

The diet of these species would seem to entitle them to rank as insectivorous, but it is doubtful whether the State laws protecting insectivorous birds contemplated including any birds of prey under that term.

LISTS OF SPECIES PROTECTED IN EACH STATE AND IN THE CANADIAN PROVINCES.

For convenience in comparison, the lists of birds protected under various State laws have been brought together in tabular form. But as these State lists have little uniformity (see pp. 56–84), it has been necessary to adopt some definite order of sequence, and for this reason the species have been rearranged in accordance with the Check List of the American Ornithologists' Union. Although the enumeration under different States is yet far from uniform, still this plan has the advantage of bringing related birds together; certain species, like birds of prey, woodpeckers, and whippoorwills, if mentioned at all in the law, will usually be found near the beginning of each of the lists here given, while certain others, such as thrushes, robins, and bluebirds, will be found at the end.

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[1] For a full discussion of the food of hawks and owls, based on an examination of nearly 3,000 stomachs, see A. K. Fisher, 'Hawks and Owls of the United States', Bull. 3, Div. Ornith. and Mamm., 1893; 'Hawks and Owls from the Standpoint of the Farmer', Yearbook Dept. Agr., 1894, pp. 215–232.

[2] Bull. Hawks and Owls, p. 116.

Local names have been carefully preserved, so that the same bird often appears under several designations, as 'wake-up' or 'yellow hammer' for flicker, and 'chewink,' 'joree,' 'joewink,' or 'ground robin' for towhee. The penalties fixed by law for killing birds or destroying nests or eggs show nearly as much diversity as the lists of species. Some States impose the same penalty for both offenses, others have none for the destruction of eggs, while still others impose heavier penalties for destruction of eggs than for the killing of birds, and protect more species. With one or two exceptions, the fines vary from $1 to $100, but are usually less than $25. In Florida a violation of the plume-bird law is punishable by a fine not exceeding $300, or imprisonment not exceeding six months, at the discretion of the court.

List of species protected in each State and in the Canadian Provinces, with penalties for killing the birds and destroying nests and eggs.*

State or Territory.	Species protected.	Penalties.	
		Birds.	Eggs.
Alabama	Tilcup, kildee, turtle dove, cuckoo, rain crow, hairy woodpecker, downy woodpecker, pileated woodpecker, red-headed woodpecker, red-bellied woodpecker, whippoorwill, nighthawk, swift, hummingbird, phœbe bird, pewee, shore lark, cowbird, starling or bunting, meadowlark, fieldlark, oriole, grackle, finch, linnet, sparrow, American sparrow, hair bird, snowbird, chewink, redbird, grosbeak, indigo bird, blue finch, joree, tanager, martin, swallow, shrike, vireo, warbler, yellowbird, chat, redstart, mockingbird, catbird, wren, nuthatch, titmouse, chickadee, gnatcatcher, thrush, robin, bluebird, or any bird of song.	Not less than $10.	Not less than $50.
Arizona	Dove	Misdemeanor.	Misdemeanor.
Arkansas	All wild birds (other than game birds, English sparrow, hawks, eagles, owls, and other birds of prey, crow, blackbirds).	$3 to $10	$3 to $10
California	Hummingbird, English skylark, canary, mockingbird, thrush, robin.	$20 to $500	$20 to $500
	Blue crane	$50 to $100	$50 to $100
Colorado	Turkey buzzard, whippoorwill, kingbird, raven, crow, bobolink, red-winged blackbird, lark, oriole, finch, sparrow, snowbird, song sparrow, martin, swallow, mockingbird, wren, thrush, robin, other insectivorous birds.	$10 to $300	

* For convenience in reference, the species have been arranged in a uniform order, according to the Check List of the American Ornithologists' Union, but the common names have been strictly followed in all cases.

List of species protected in each State and in the Canadian Provinces, etc.—Continued.

State or Territory.	Species protected.	Penalties.	
		Birds.	Eggs.
Connecticut	Eagle	$25 to $50	....
	Woodpecker, whippoorwill, nighthawk, chimney swift, hummingbird, flycatcher, phœbe, bobolink, Baltimore oriole, purple finch, sparrow, rose-breasted grosbeak, indigo bird, scarlet tanager, martin, swallow, cedar bird, vireo, warbler, yellowbird, catbird, wren, creeper, nuthatch, titmouse, chickadee, kinglet, thrush, robin, bluebird, other song or insectivorous birds.	$1	$1
Delaware	Woodpecker, sapsucker, flicker, wakeup, whippoorwill, nighthawk, hummingbird, skylark, oriole, ground robin, redbird, martin, swallow, yellowbird, mockingbird, catbird, wren, thrush, robin, bluebird.	$1	*$1
District of Columbia.	Turkey buzzard, woodpecker, sapsucker, whippoorwill, hummingbird, pewit, blue jay, oriole, hanging bird, crow blackbird, goldfinch, cardinal, martin, swallow, mockingbird, catbird, wren, wood robin, robin, bluebird, and other insectivorous birds.	$5	$5
Florida	Ibis, heron, egret, crane, curlew	† $300	‡ $20
Georgia	Insectivorous or singing birds	Misdemeanor.	Misdemeanor.
Illinois	Wild birds (other than game birds, English sparrow, chicken hawks, crows, or crow blackbirds).	$5	$5
Indiana	Wild birds (other than game birds, English sparrow, hawks, and other birds of prey, or crows).	$10 to $50	$10 to $50
Iowa	Sandpiper, turtle dove, whippoorwill, nighthawk, bobolink, lark, blackbird, finch, linnet, snowbird, martin, swallow, catbird, wren, thrush, robin, bluebird, and other harmless birds.	$1 to $25	$1 to $25
Kansas	Turtle dove, yellow-hammer, blue jay, oriole, meadowlark, redbird, mockingbird, thrush, robin, bluebird.	$5 to $100	....
Kentucky	Woodpecker, flicker, meadowlark, oriole, redbird, finch, tanager, martin, swallow, catbird, thrush, bluebird, and other song or insectivorous birds.	$5 to $25	$5 to $25
Louisiana	Whippoorwill, nighthawk, oriole, blackbird, finch, sparrow, swallow, mockingbird, bluebird, and any song bird.	$5 to $25	$5 to $25
Maine	Tern	$1 to $10	....
	Woodpecker, oriole, lark, sparrow, swallow, robin, and other insectivorous birds.	$1 to $5	$1 to $10
Maryland	Herring gull, mackerel or other gull, turkey buzzard, sapsucker, whippoorwill, hummingbird, pewit, blue jay, lark, oriole, goldfinch, sparrow, joewink, redbird, indigo bird, martin, swallow, cedar bird, yellow-breasted chat, mockingbird, catbird, wren, thrush, wood robin, red-breasted robin, bluebird.	$1 to $5	$5 to $25
Massachusetts	Wild birds (other than game birds, English sparrow, certain fresh-water and sea fowl, birds of prey, crows, jays, and crow blackbirds).	$10	$10

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* "Or destroy the eggs or nest of any of the aforesaid birds, or *any other birds* except hawks, owls, crows, and English sparrows."

† Not more than amount stated.

‡ Eggs or young of sea or plume birds.

List of species protected in each State and in the Canadian Provinces, etc.—Continued.

State or Territory.	Species protected.	Penalties.	
		Birds.	Eggs.
Michigan	Sea gull, woodpecker, whippoorwill, nighthawk, bobolink, lark, oriole, finch, martin, swallow, yellowbird, catbird, brown thrasher, wren, thrush, robin, bluebird, or any song or insectivorous bird.	$10 to $125	....
	Mourning dove	$5 to $100	....
Minnesota	Whippoorwill, nighthawk, bobolink, lark, finch, linnet, martin, swallow, catbird, wren, thrush, robin, bluebird, and any other harmless bird.	$10 to $25	$10 to $100
Mississippi	Turtle dove, starling or fieldlark (March 1 to September 15).	$5 to $25	*$1 to $25
	Mockingbird, catbird, thrush, or nest of any wild bird (except English sparrow, hawks, owls, and other birds of prey, blue jay, crow, and blackbirds).	$1 to $10	*$1 to $25
Missouri	Wild song birds or insectivorous birds	$10 to $50	$10 to $50
Montana	Stork, woodpecker, meadowlark, oriole, goldfinch, snowbird, cedar bird, mockingbird, thrush, bluebird, and ‘other of the small birds known as singing birds.’	$5 to $100	$5 to $25
Nebraska	Turtle dove, cuckoo, woodpecker, yellow-hammer, kingbird, jay, bobolink, lark, oriole, sparrow, swallow, yellowbird, wren, thrush, robin, bluebird, and other insectivorous or song birds.	$3 to $10	....
Nevada	Hummingbird, blue jay, meadowlark, sparrow, martin, mockingbird, catbird, wren, thrush, red breast, robin, bluebird, and any song birds.	$25 to $200	$25 to $200
New Hampshire	Bald eagle	$40	....
	Woodpecker, hummingbird, flycatcher, bobolink, lark, oriole, finch, sparrow, bunting, tanager, martin, swallow, vireo, warbler, creeper, nuthatch, thrush, robin, bluebird, and other song or insectivorous birds.	$5	†$2
New Jersey	Woodpecker, whippoorwill, nighthawk, meadowlark, oriole, finch, cardinal, cedar bird, tanager, martin, barn swallow, thrush, robin, and other insectivorous birds.	$20	$20
New York	Wild birds (other than certain specified game birds, English sparrow, crane, hawk, kingfisher, raven, crow, common blackbird, and crow blackbird).	‡$60	$60
North Carolina	Dove, lark, mockingbird, robin	§$10	....
North Dakota	Any song bird or insect-eating bird (except certain specified game birds).	§$10	§$10
Ohio	Mouse hawk, eagle, woodpecker, flicker, whippoorwill, hummingbird, flycatcher, pewee or phœbe bird, blue jay, starling, bobolink, redwing, oriole, goldfinch, sparrow, snowbird, chewink, ground robin, redbird, grosbeak, bunting, tanager, purple martin, waxwing, vireo, warbler, redstart, catbird, brown thrasher, wren, creeper, nuthatch, titmouse, chickadee, gnatcatcher, and robin.	$25 to $100	$25 to $100
Oklahoma	Turkey buzzard, martin, swallow, wren, robin, and insectivorous birds.	$25 to $100	....

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* Twelve counties excepted from section relating to eggs.
† Nests of certain birds only.
‡ Also an additional penalty of $25 for each bird or part thereof (see p. 74).
§ Not exceeding.

List of species protected in each State and in the Canadian Provinces, etc.—Continued.

State or Territory.	Species protected.	Penalties.	
		Birds.	Eggs.
Oregon	Horned lark, meadowlark, oriole, California linnet, American goldfinch, pine linnet, lark finch, snowbird, song sparrow, grosbeak, lazuli finch, tanager, swallow, vireo, warbler, yellow-breasted chat, house wren, winter wren, kinglet, wood thrush, hermit thrush, robin, variegated thrush, bluebird.	$5 to $100	$5 to $100
	Sea-gull, meadowlark, mockingbird, Oregon robin (and 12 introduced European birds).	$25 to $200	$25 to $200
Pennsylvania	Least bittern, tiltup, killdeer, cuckoo, hairy woodpecker, downy woodpecker, pileated woodpecker, red-headed woodpecker, red-bellied woodpecker, whippoorwill, nighthawk, swift, hummingbird, phœbe bird, pewee, shore lark, starling, cowbird, meadowlark, oriole, grackle, finch, linnet, sparrow, hair bird, snowbird, chewink, grosbeak, blue finch, indigo bird, bunting, tanager, martin, swallow, shrike, vireo, warbler, yellowbird, chat, redstart, catbird, wren, nuthatch, titmouse, chickadee, gnatcatcher, thrush, robin, bluebird, or any bird of song.	$10	$50
Rhode Island	Wild birds (other than game birds, English sparrow, hawks—except fish hawk—owls, crows, and crow blackbirds).	$20	$20
South Carolina	Turkey buzzard, woodpecker, whippoorwill, hummingbird, flycatcher, lark, oriole, finch, warbler, thrasher, nuthatch, bluebird, and other insectivorous and harmless land birds which are unfit for food.	$10	$10
	Woodpecker, beebird, redbird, nonpareil, swallow, mockingbird, wren, thrush.	$5	$10
South Dakota	Any song bird or insect-eating bird, except crow, blackbirds, and sparrows.	*$10	*$10
Tennessee †	Woodpecker, oriole, sparrow, redbird, mockingbird, catbird, thrush, robin, bluebird, and other song or insectivorous birds.	$2.50 to $5.00	$2.50 to $5.00
Texas	Sea gull, tern, shearwater, pelican, heron, egret	$5 to $25	$5 to $25
	Buzzard or carrion crow, whippoorwill, nighthawk, scissortail, bobolink, linnet, finch, sparrow, redbird, nonpareil, martin, swallow, mockingbird, catbird, wren, thrush, bluebird.	$5 to $15	....
Utah	Gull, hawk, owl, whippoorwill, lark, snowbird, swallow, thrush, robin, and other insectivorous or song birds.	‡ $10	‡ $10
Vermont	Wild birds, (other than 10 specified game birds, and certain species considered injurious).	$5	$5
Virginia	Gull or striker, turkey buzzard or black buzzard, starling, cardinal, house martin, mockingbird, brown thrush, wood robin, bluebird.	$10	§ $10
Washington	Skylark, meadowlark, goldfinch, wild canary bird, bullfinch, greenfinch, black starling, grosbeak, mockingbird, nightingale, black thrush, gray singing thrush, English robin, red-breasted robin, or other song bird.	$10 to $100	$10 to $100

* Not exceeding. † County legislation only. ‡ Not less than.

§ Nests only, except in the case of gulls, whose eggs are protected after July 20.

List of species protected in each State and in the Canadian Provinces, etc.—Continued.

State or Territory.	Species protected.	Penalties.	
		Birds.	Eggs.
West Virginia	Dove, turkey buzzard, cuckoo, woodpecker, yellowhammer or flicker, whippoorwill, hummingbird, phoebe bird or pewee, blue jay, redwing, oriole, blackbird, purple grackle, family Fringillidæ or sparrows, finch, crossbill, chewink, redbird or cardinal grosbeak, indigo bird, martin, swallow, warbler, redstart, mockingbird, catbird, wren, nuthatch, titmouse, tit or tomtit, dummock, nightingale, thrush, robin, Hungarian robin, bluebird, and other birds not predatory or destructive to crops.	$2 to $25	$2 to $25
Wisconsin	Turtle dove, whippoorwill, nighthawk, lark, finch, thrush, robin, bluebird, and other harmless birds.	*$50	*†$5
Wyoming	Turkey buzzard, whippoorwill, lark, finch, snowbird, thrush, robin, or other insectivorous birds.	$10 to $50	....
British Columbia	Gull, bittern, skylark, meadowlark, linnet, chaffinch, English blackbird, thrush, robin, and birds living on noxious insects.	(‡)	(‡)
Manitoba	Any birds (except game birds and certain species considered injurious).	$1 to $20	$1 to $20
New Brunswick	Sea gull, small birds which frequent the fields and woods (except English sparrow, crow, and blackbird).	$5	$5
Newfoundland	Wild or migratory birds (January 12 to August 20)	$25 to $200	....
Nova Scotia	Sparrow, swallow, robin, other small birds, and birds of song which frequent fields and gardens.	$1	$1
Ontario	Wild native birds (other than game birds, English sparrow, hawks, crow, and blackbirds).	$1 to $20	$1 to $20
Quebec	Cuckoo, woodpecker, whippoorwill, hummingbird, birds known as perchers, kingbird, flycatcher, bobolink, cowbird, grackle, finches (song sparrow, redbird, indigo bird, etc.), goldfinch, grosbeak, swallow, warbler, titmouse, kinglet, grive (robin, wood thrush, etc.).	$2 to $5	$2 to $5

* Not exceeding.
† Eggs or nest of any water fowl or other birds, except crows and English sparrows.
‡ Penalties fixed by lieutenant-governor in council.

SPECIES SPECIFICALLY EXEMPTED FROM PROTECTION.

Twenty-seven States, the District of Columbia, and four Canadian Provinces exempt from protection certain species which are commonly considered injurious. These species include (1) the English sparrow; (2) birds which destroy poultry and game, as certain hawks and owls; (3) birds which destroy grain, as blackbirds, crows, and ricebirds; (4) birds which destroy fish, as loons, fish-eating ducks, herons, and kingfishers. Of these thirty-two[1] States and Provinces, twenty-eight specifically mention the English sparrow, and South Dakota and Quebec virtually include it with other sparrows, thus leaving only two

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[1] Including the District of Columbia.

(Nevada and South Carolina) which do not include it in the list of injurious species.

At least nineteen States and Provinces, including those which have the most comprehensive protective laws, except birds of prey. Some withdraw protection from all birds of prey, others only from hawks, still others from 'chicken hawks,' or hawks and owls 'destructive to poultry,' while a few, like Alabama and Pennsylvania, specify particular species, as Cooper's hawk and the sharp-shinned hawk.

Twenty-two States and Provinces exempt birds destructive to grain, particularly the crow, crow blackbird, and ricebird; and eight (mainly in New England and the Middle States) birds considered destructive to fish. Among fish-eating birds, loons are excepted in Maine,[1] Vermont, and Manitoba, certain water fowl in Massachusetts, herons in Maine[1] and Vermont, the green heron and night heron in Alabama and Pennsylvania, bitterns in Vermont and Manitoba, and kingfishers in Alabama, New Jersey, New York, Pennsylvania, Manitoba, and Quebec.

The species exempted by each State are shown in the following list:

List of birds specifically exempted from protection.

State.	Species.
Alabama	English sparrow, green heron, night heron, sharp-shinned hawk, Cooper's hawk, duck hawk, pigeon hawk, barred owl, great horned owl, kingfisher.
Arkansas	English sparrow, hawks, eagles, owls, and other birds of prey, crow, blackbirds.
Connecticut	English sparrow.
Delaware	English sparrow, hawks, owls, crows.
District of Columbia	English sparrow.
Georgia	English sparrow, night hawks, crows, ricebirds, larks, wheat birds.
Illinois	English sparrow, chicken hawk, crow, crow blackbird.
Indiana	English sparrow, hawks, and other birds of prey, crow.
Iowa	English sparrow, blue jay.
Maine	English sparrow, hawks, crow, and the young of loons, herons, and owls.
Maryland	English sparrow, hawks, and other birds destructive to poultry, crow, blackbirds.
Massachusetts	English sparrow, birds of prey, jays, crow, crow blackbird, certain fresh-water and sea fowl.
Michigan	English sparrow, blue jay, blackbirds, butcher bird.
Minnesota	English sparrow, hawks, crow, blackbirds.
Mississippi *	English sparrow, hawks, owls and other birds of prey, blue jay, crow, blackbirds.
Nevada	Linnet (house finch).
New Hampshire	English sparrow.
New Jersey	English sparrow, cranes, hawks, kingfisher, raven, crow, red-winged blackbird, crow blackbirds.
New York	English sparrow, cranes, hawks, kingfisher, raven, crow, common blackbird, crow blackbirds.
Ohio	English sparrow.
Pennsylvania	English sparrow, green heron, night heron, sharp-shinned hawk, Cooper's hawk, duck hawk, pigeon hawk, barred owl, great-horned owl, kingfisher.

*Applies only to nests; not to the birds themselves.

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[1] Young only.

List of birds specifically exempted from protection—Continued.

State.	Species.
Rhode Island	English sparrow, birds of prey (except the fish hawk), crow, crow blackbirds.
South Carolina	Hawks, eagles, owls, crow, crow blackbirds, jackdaw (boat-tailed grackle).
South Dakota	Crow, sparrows, blackbirds.
Utah	English sparrow.
Vermont	English sparrow, mergansers, loons, bitterns, blue heron, birds of prey, jays, crow, crow blackbird.
West Virginia	English sparrow.
Wisconsin	English sparrow, crow, blackbirds.
Manitoba	English sparrow, loons, gulls, cormorants, pelicans, mergansers, bitterns, cranes, curlews, wild pigeon, falcons, eagles, hawks, owls, kingfisher, jays, ravens, crow, blackbirds, rusty grackle, purple grackle, shrikes.
New Brunswick	English sparrow, crow, blackbirds.
Ontario	English sparrow, hawks, crow, blackbirds.
Quebec	Wild pigeon, falcons, eagles, hawks, owls, kingfisher, magpie, jays, raven, crow, starlings, sparrows, waxwings (recollets), shrikes.

PERMITS FOR COLLECTING BIRDS AND EGGS FOR SCIENTIFIC PURPOSES.

The rights of ornithologists and bird students should be recognized as well as those of sportsmen. Collecting birds and eggs for scientific purposes under proper restrictions is not only legitimate, but should be encouraged, and failure to recognize and provide for the needs of students retards the progress of natural-history work.

Provisions for collecting specimens have been made by a majority of the States, and should be adopted by all. Twenty-five States, the District of Columbia, and six Canadian Provinces either make an exception in the case of birds collected for scientific purposes or furnish students with permits authorizing the holder to collect under certain conditions for a definite length of time. North Dakota makes it unlawful for anyone, whether resident or nonresident, to kill birds without first obtaining a hunting permit.

These certificates, or permits, are generally issued by some State officer, such as the fish and game commissioner or game warden, on satisfactory evidence that the applicant is a fit person to receive them, the evidence being usually required in the form of testimonials from two well-known scientific men. A minimum age limit is insisted on by certain States: In Massachusetts holders of certificates must be 21, in Maryland, New Jersey; and New York at least 18, while in Illinois, Pennsylvania, and Rhode Island the recommendation of the American Ornithologists' Union is followed, and permits are issued to applicants of 15 years or over. A bond of $100 or $200, signed by two responsible residents of the State or county, is required in Alabama, Colorado, Connecticut, Illinois, Indiana, Minnesota, New Jersey, New York. Ohio. and Pennsylvania, and a small fee varying from $1 to $5 is charged to cover the cost of issuing certificates. Restrictions limiting the time, number of permits issued, and disposition of specimens are also imposed by several States. Certificates are issued for periods varying from two years to a few months—in Indiana and Ohio for two years, in Alabama, Connecticut, Minnesota, New Jersey, New York, and Pennsylvania for one year, in Colorado for three months, and in Illinois until the first of June following date of issue. Maine limits the number of permits in force at one time to ten and Vermont to five. Colorado, Maine, Minnesota, and Wisconsin issue certificates only on condition that the specimens collected shall be exchanged, and not sold or disposed of by gift.

While such permits should be guarded by all necessary restrictions to prevent abuse, still the formality of obtaining them should be as simple as possible and the fees should be within the reach of all deserving students. High fees and large bonds are objectionable for the reason that some persons who are otherwise entirely qualified are unable to comply with these conditions. A nominal fee of $1 should be sufficient to deter many who simply desire a license to shoot and who might apply for the permit if it were to be had for the asking, while the requirement of testimonials from two responsible scientific men will insure the carrying out of the intent of the law. It may well be questioned whether the limitations as to number insisted on by Maine and Vermont are wise, for it might easily happen in a large State that the number of students who desired to collect would greatly exceed the permit limit set by law, while the depletion in the ranks of the birds by such collecting is comparatively trifling. The Committee on Protection of Birds of the American Ornithologists' Union especially recommends that the age limit should *not* be placed higher than 15 years, as this would prevent young students from collecting at a time when they most need encouragement.

The chief requirements of the various States regarding certificates are shown in the following table:

Regulations and permits for collecting birds, nests, and eggs for scientific purposes.

State.	Permits issued by—	Testimonials from—	Fee.	Bond.	Remarks.
Alabama	Probate judge of county.	....	$5	$100	In force 1 year; applicant must be 15 or over.
California *	....	....	....	....	
Colorado	Forest, game, and fish commissioner.	Two well-known citizens.	5	100	In force 3 months; applicant must be member of, or accredited by, Natural History Society, specimens can only be exchanged.
Connecticut *	President board commissioners of fisheries and game.	Officer Hartford Scientific Society.	1	200	In force 1 year.

* Law not applicable to specimens collected for educational purposes.

Regulations and permits for collecting birds, nests, ana eggs for scientific purposes—Con.

State.	Permits issued by—	Testimonials from—	Fee.	Bond.	Remarks.
District of Columbia.	Superintendent of police.				Under restrictions prescribed by Secretary of Smithsonian Institution.
Illinois	County clerk	Two well-known scientific men.	$1	$200	In force until June 1 following date of issue; applicant must be 15 or over.
Indiana	Executive board Indiana Academy of Science.	Two well-known scientific men.	1	200	In force 2 years.
Kansas *					
Maine	Commissioners inland fisheries and game.		5		Licenses limited to 10 at one time; specimens can only be exchanged; no Sunday collecting.
Maryland	State game warden				Permit issued upon filing application and affidavit; applicant must be 18 or over.
Massachusetts	Game commissioners, or president Boston Society of Natural History.				Applicant must be of age.
Michigan	State game and fish warden.				
Minnesota	Board game and fish commissioners.	Two well-known scientific men.	2	100	Applicant must be member of, or accredited by, scientific society; specimens can only be exchanged; in force 1 year.
Montana †					
Nevada *					
New Hampshire. ‡					
New Jersey	Board fish and game commissioners.	Two scientific men	1	200	In force 1 year; applicant must be 18 or over; bondsmen must be property holders of the State.
New York	Any incorporated society of natural history in the State or regents University of New York.	Two well-known scientific men.	1	200	In force 1 year; applicant must be 18 or over.
North Dakota	County auditor		75 cts.		In force until Dec. 31 following date of issue; nonresident fee, $25.
Ohio	President fish and game commission.	Two well-known scientific men or teachers of science.	1	100	In force 2 years.
Pennsylvania	Board game commissioners.	Two well-known scientific men.	5	100	In force 1 year; applicant must be 15 or over.

* Law not applicable to specimens collected for scientific purposes.

† Law not applicable to specimens collected under direction of any State educational institution.

‡ Law not applicable to specimens collected for an educational institution under direction of the curator.

Regulations and permits for collecting birds, nests, and eggs for scientific purposes—Con.

State.	Permits issued by—	Testimonials from—	Fee.	Bond.	Remarks.
Rhode Island	(1) Curator Museum Zoology, Brown University; (2) president Rhode Island College of Agriculture; (3) any incorporated society of natural history; or, (4) any college in the State.				Applicant must be 15 or over.
South Carolina.*					
Texas †					
Vermont	Fish and game commissioners.				Permits limited to 5 in force at one time.
Wisconsin	Fish and game warden.	Well-known scientists.			Applicant must be member of, or accredited by, Society of Natural History or educational institution; specimens can only be exchanged.
British Columbia.‡					
Manitoba	Minister of Agriculture.				
New Brunswick.	Surveyor-General				
Nova Scotia	Provincial Secretary.				
Ontario	Chief game warden				In force to end of calendar year in which issued.
Quebec	Commissioner lands, forests, and fisheries.				Nonresident fee $5 to $25.

* Law not applicable to specimens collected for scientific purposes.
† Law not applicable to specimens of plume birds collected for scientific purposes.
‡ Law not applicable to specimens collected by curator, assistants, or agents of Provincial Museum.

LICENSES AND OTHER REGULATIONS REGARDING SHOOTING.

General regulations regarding shooting belong more properly to a treatise on game laws, but since in some States they are made to cover all birds, they may be considered very briefly in this connection. Their primary object, of course, is game preservation whether by restricting hunting, limiting the number of birds which may be killed in a day or a season or the purposes for which they may be killed, or establishing special close seasons. The system of gun licenses which is strongly advocated by the League of American Sportsmen, and which has been adopted recently in Wyoming for big game, does not seem to have been applied thus far to birds in general. Hunting licenses, however, are required in North Dakota, where it is unlawful to kill any birds without a permit. A sharp distinction is drawn between residents and nonresidents of the State, for residents may obtain a license for 75 cents, whereas nonresidents must pay $25. In Virginia, nonresidents are prohibited from killing wild fowl below the head of tide water except in Accomac and Northampton counties; and in Missouri they are prohibited from killing certain specified game. Nonresident licenses are required in some of the counties of Maryland, and also in Arkansas, Delaware, Florida, Illinois, South Carolina, South Dakota, West Virginia, and Wisconsin, as well as in British Columbia, Manitoba, Nova Scotia, Ontario, Quebec, and the Northwest Territories. In some States they apply only to game birds; in others they cover all species. The fee ordinarily varies from $10 to $25, but amounts to $50 in British Columbia. Full information on this point, as well as on the manner of obtaining permits, may be found in the various State laws or in 'Game Laws in Brief' (New York, 1900).

Restrictions regarding bags, or the number of birds which may be killed within a specified time, are becoming rather common; and a few States forbid absolutely the killing of certain birds for sale. Non-export clauses, prohibiting the shipment into other States of birds and game protected by local acts, have been incorporated into the game laws of a number of States during recent years, and have been upheld by the Supreme Court of the United States.[1] Thus, Delaware imposes a fine of $5 for each robin, partridge, quail, or woodcock exported; Massachusetts, a fine of $10, and Rhode Island, a fine of $20 for each ruffed grouse, quail, or woodcock shipped out of the State. Kansas, Michigan, Minnesota, Nebraska, New Jersey, Pennsylvania, and Utah also forbid export of game and certain birds.

Regulations as to the manner or time of hunting—as, for example, prohibiting the use of swivel guns or shooting between sunset and sunrise—are confined almost entirely to game birds; but laws governing shooting on Sunday apply equally to birds of all kinds. Nine States, the District of Columbia, and several Canadian Provinces, viz, Alabama, Delaware, Maine, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, District of Columbia, New Brunswick, Ontario, and Newfoundland, prohibit shooting on Sunday, thus making that day in effect a special close season.[2]

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[1] Geer *v.* State of Connecticut, 161 U. S., 519.

[2] References to Sunday laws are as follows: Alabama, Gen. Laws, 1898–99, p. 77, sec. 1; Delaware, Rev. Stat., 1893, Ch. LV, sec. 7, p. 457; District of Columbia, 30 Stat. L., p. 1012; Maine, Laws of 1899, ch. 42, sec. 22, p. 42; Massachusetts, Acts of 1899, ch. 116, p. 57; New Jersey, Laws of 1895, Ch. CCLV, sec. 15, p. 478; New York, Penal Code, sec. 1109; North Carolina, Code of 1883, sec. 2837, p. 236; Ohio, Rev. Stat., 1897, sec. 6961, p. 3198; Pennsylvania, Laws of 1897, No. 103, sec. 1, p. 123; New Brunswick, Laws of 1899, Ch. VIII, sec. 4; Ontario, Laws of 1896, ch. 193, sec. 24; Newfoundland, Act of 1899, sec. 10.

BIRDS IN CAPTIVITY.

State laws generally prohibit the trapping, netting, or snaring of birds, for it is well known that a rapid decrease in numbers, amounting almost to extermination in the case of certain species, would speedily follow the wholesale capture which is possible under these methods. Such restrictions, aimed mainly at market hunters, are intended primarily to insure the preservation of game birds, but they are often needed to protect some of the smaller song or insectivorous species. In the vicinity of some of the larger cities a regular business is carried on in trapping certain native birds which are in demand for pets or cage birds. Mockingbirds, brown thrushes, bobolinks, cardinals, black-headed grosbeaks, indigo birds, nonpareils, housefinches, goldfinches, and others are captured in large numbers for sale.

Ordinarily no objection is made to keeping caged birds as pets, although there may be considerable difference of opinion on the question as regards native birds.[1] But when large numbers are systematically trapped in any locality to supply the trade the practice is very properly condemned, and steps are usually taken to restrict the operations of the bird trappers.

Some State laws are so worded as to prevent the capture of song birds for purposes of domestication or propagation, and in a few instances the matter has been deemed of sufficient importance to warrant making exceptions in favor of owners of captive birds. At least ten States and the Provinces of British Columbia and Ontario have legislated on this point, as follows:

Alabama: "Nothing herein shall be construed to prevent the keeping of song birds in cages as domestic pets." (Gen. Laws, 1898–99, p. 77, sec. 2.)

California: "Every person who, in the State of California, shall at any time hunt, * * * take, * * * buy, sell, give away, or have in his possession, *except for the purpose of propagation*, or for educational or scientific purposes, any English skylark, robin, canary, humming bird, thrush, or mockingbird * * * is guilty of a misdemeanor," provided, however, that the right of possession for the purpose of propagation shall first be obtained by a permit in writing from the board of fish commissioners of the State of California. (Penal Code, 1897, p. 216, sec. 626.)

Iowa: "Nothing herein shall be construed to prevent * * * the keeping of song birds in cages as domestic pets." (Annotated Code, 1897, sec. 2561, p. 888.)

Louisiana: "That no person shall entrap, net, kill, or pursue with such intent, or have the same in possession at any time during the year, any song bird, especially the mockingbird, except domesticated birds, except the birds be entrapped or netted for the purpose of domestication." (Rev. Laws, 1897, p. 247, sec. 6.)

Maryland: "Provided, that it shall be lawful to have mockingbirds or redbirds or other song birds in cages." (Laws of 1898, ch. 206, sec. 15H.)

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[1] For arguments pro and con on 'the question of the ethics of caging birds,' see Bird Lore, I, pp. 158–162, October, 1899.

Michigan: "Nothing in this act shall prevent the taking or catching alive of birds, game or fish for domestication, propagation, or breeding purposes." (Public Acts, 1893, No. 196, sec. 5.)

Minnesota: "But nothing herein contained shall be construed to prevent the keeping of song birds as domestic pets." (Gen. Laws, 1897, ch. 221, sec. 10.)

New Jersey: "That nothing in this act shall be construed to prevent associations or individuals from domesticating or bringing into this State any animals or birds for the purpose of propagating the same, or keeping the same until a reasonable opportunity offers for their release." (Gen. Public Laws, 1895, Ch. CCLV, sec. 16.)

Pennsylvania: "But nothing herein shall be construed to prevent the keeping of song birds in cages as domestic pets." (Laws of 1897, no. 103, sec. 2, p. 124.)

South Carolina: "Provided, that nothing herein contained shall prohibit any person from taking and keeping any bird of song or plumage for his own pleasure or amusement, and not for sale, traffic, or gain." (Rev. Stat., 1893, Vol. II, p. 405, sec. 427.)

British Columbia: "Provided, however, it shall be lawful for the Provincial Secretary, on such conditions as he shall think fit, by writing under his hand, to at any time authorise any person to trap or have in his possession any birds, or take eggs, for breeding or acclimatization purposes." (Stat., 1898, ch. 24, sec. 7.)

Ontario: "Nothing in this act contained shall be held * * * to apply to any imported cage birds or other domesticated bird or birds generally known as cage birds." (Rev. Stat., 1897, ch. 289, sec. 1.)

ENFORCEMENT OF PROTECTIVE LAWS.

To the efforts of private individuals or organizations interested in game protection are primarily due not only the existence, but what is more important, the enforcement of most of the laws now on the statute books. Probably no branch of criminal law depends so much for its enforcement on the interest and public spirit of the individual as that relating to the protection of game and birds. Experience has shown that under ordinary circumstances such measures are apt to become dead letters unless the regular officials charged with enforcing the laws happen to be personally interested in game protection. For this reason special officers, known as game wardens or deputy wardens, are usually employed; and it is customary in many States, in case of conviction, to pay part of the fine to the person instrumental in causing the arrest, as an inducement to bring violators of the game laws to justice.

In the United States regulations for the protection of birds are enforced by several different agencies, both State and private, which may be conveniently arranged in four groups: (1) State fish and game commissions or wardens, supported in twenty-nine States; (2) national organizations, such as the League of American Sportsmen, which has branches in twenty-two States, and the American Ornithologists' Union, which has a special committee on protection; (3) fish and game protective associations—voluntary organizations of enthusiastic and public-spirited sportsmen, which have been formed in many States and which are represented by State associations in at least seventeen; and, (4) Audubon societies, now represented in twenty-three States.[1] While these different organizations naturally overlap one another in their fields of labor, they work harmoniously for the common cause. The fish and game associations are naturally most active in protecting game birds within their respective States, while the Audubon societies are interested more especially in the protection of birds that are not game. The activities of the latter societies are not necessarily limited by State lines. Efforts are constantly made to extend the work in new fields, and recently the Pennsylvania Audubon Society has done effective work for the protection of insectivorous birds in Delaware. The labors of both game associations and Audubon societies are supplemented by those of the League of American Sportsmen and the committee of the American Ornithologists' Union. The League has a membership of over 2,700, and one of its main objects is the enforcement of game laws; it not only prosecutes violations of State laws, but offers rewards to wardens in any State who secure convictions. The American Ornithologists' Union committee now has a special fund at its disposal which will be devoted this year largely to protecting gulls and terns along the Atlantic coast.

In States where the importance of protection has long been recognized and is strongly supported by public sentiment, fish and game protection is in charge of a board of commissioners and regular wardens are employed by the State to enforce the game laws. New York includes forestry in the duties of its board, and has five commissioners of fisheries, game, and forests, but the majority of the States combine fish and game matters, although a few consider the subjects of sufficient importance to require the attention of separate officials. Thus, Illinois has a State game commissioner, Pennsylvania has a board of seven game commissioners distinct from its fish commission, Rhode Island a board of five commissioners of birds, and North Dakota, Oregon, and Wyoming have special game wardens.

NECESSITY FOR FURTHER STATE LEGISLATION.

In a suggestive paper on "The destruction of our birds and mammals," Mr. William T. Hornaday[2] has made estimates of the decrease in bird life in the United States during the last fifteen years, based on reports from observers in thirty different States.

Such estimates are of course merely matters of opinion, but nevertheless are interesting. Naturally there is a wide range in the opinions of the various observers, and the alleged decrease of birds varies from 10 to 77 percent, while the average for the thirty States is 46 percent. Nebraska shows a decrease of only 10 and Massachusetts of 27 percent, but the percentage runs up to 67 in Texas, 75 in Connecticut, Indian Territory, and Montana, and to 77 in Florida. Evidently existing State laws are defective or are not properly enforced!

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[1] For a list of these commissions and the more important State associations, with their officers, see Appendix to the Yearbook Dept. Agr., 1899, pp. 710–717.

[2] Second Annual Report New York Zoological Society, p. 95, 1898.

Some States and Territories, as Idaho, Alaska, Arizona, Indian Territory, and New Mexico, apparently afford no protection at present to birds other than game; and while the necessity for such legislation may be small in unsettled portions of the West, still it will be more and more urgent as the country becomes developed. Other States which have bird laws on their statute books really afford very little protection, because these laws apply to only a small number of species, are limited to only part of the year, or are restricted to only part of the State. Aside from game birds and the young of sea birds, Florida protects only ibises, herons, egrets, cranes, and curlews; North Carolina only doves, larks, mockingbirds, and robins. Kansas and Virginia name but 10 birds each, and Delaware but 20. Louisiana, while mentioning 8 (whippoorwill, nighthawk, blackbird, oriole, sparrow, finch, swallow, and bluebird), really has a somewhat more extended list, since each of the terms blackbird, oriole, sparrow, finch, and swallow includes a number of species. Alabama, Georgia, North Carolina, and Tennessee treat all birds alike in protecting them for only part of the year, and providing open seasons, as in the case of game, when they can be killed.[1] In exceptional cases, so many counties are exempted from the provisions of a law that the act becomes operative in only a small part of the State. Thus, Texas exempts 56 out of 244 counties from the operation of the act of 1895, so that a comparatively large part of the State is no better off than if there were no bird law (see fig. 8). Alabama exempts 60 out of 66 counties from the act of 1899, and thus the law actually applies to only 6 counties.

Another difficulty lies in the diverse and oftentimes contradictory laws in force in neighboring counties in the same State, as in Maryland, Virginia, and Tennessee. Special county laws[2] have long been popular in Maryland and Virginia, but the Maryland act of 1898 did much to harmonize conflicting game regulations. Mississippi gives county boards of supervisors full jurisdiction over such matters, and her bird protection therefore depends mainly on local regulations. Under the constitution of Tennessee[3] game legislation may be enacted in favor of certain counties or geographical districts, and various sections of the State, availing themselves of this provision, have different laws.

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[1] The open seasons are as follows: Alabama, November 1 to March 1 (except red-headed woodpecker, catbird, pewee, and vireo, which are protected from August 1 to March 1, and mockingbirds which are protected at all seasons); Georgia, November 1 to March 15; North Carolina, October 15 to April 1; Tennessee, varying from three to eight months, according to the county.

[2] New York has special laws for Long Island, Michigan for the Upper Peninsula, and Washington for that part of the State east of the Cascades, but these regulations apply chiefly to game birds. In Canada, also, there are special regulations in Quebec for the two 'zones' into which the Province is divided at the river Saguenay.

[3] Art. XI, sec. 13.

Nowhere are protective measures more needed than in the South and Southwest, and more especially in the South Atlantic and Gulf States. So many northern birds pass the winter in this part of the United States, and so many resident species begin to breed here early in spring, that it is particularly important to have the laws comprehensive

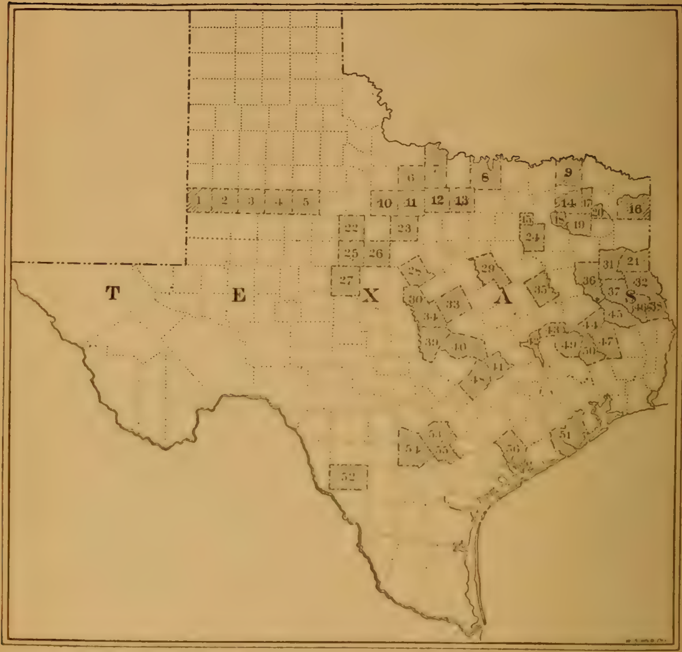

FIG. 8.—Map of Texas showing counties exempted under law of 1895 (the excepted counties are shaded and numbered):

Angelina, 45.
Archer, 6.
Atascosa, 54.
Bastrop, 48.
Brazoria, 51.
Brazos, 42.
Burnet, 39.
Callahan, 26
Camp, 20.
Cass, 16.
Cherokee, 36.
Clay, 7.
Comanche, 28.
Cooke, 8.
Coryell, 33.
Dimmit, 52.
Franklin, 17.
Freestone, 35.
Garza, 4.
Hill, 29.
Hopkins, 14.
Jack, 12.
Jackson, 56.
Jones, 22.
Karnes, 55.
Kaufman, 24
Kent, 5.
Lamar, 9.
Lampasas, 34.
Lee, 41.
Lynn, 3.
Madison, 43.
Mills, 30.
Nacogdoches, 37
Panola, 21.
Polk, 47.
Rains, 18.
Rockwall, 15.
Runnels, 27.
Rusk, 31.
Sabine, 38.
San Augustine, 46.
San Jacinto, 50.
Shelby, 32.
Stephens, 23.
Taylor, 25.
Terry, 2.
Throckmorton, 10.
Trinity, 44.
Walker, 49.
Williamson, 40.
Wilson, 53.
Wise, 13.
Wood, 19.
Yoakum, 1.
Young, 11.

and rigidly enforced. This question is one of general interest, for migratory birds, even if effectually protected during the breeding season in New England and the Northern and Middle States, may yet be killed to such an extent during their stay in the South as to render protection on their breeding grounds of comparatively little avail. The smaller land birds now receive but little protection during their sojourn in the South, with no applicable laws in Florida, and open seasons in winter in Alabama, Georgia, North Carolina, and Tennessee.

However important it may be to secure protective legislation in States which now have none, or in those which restrict it to a few months of the year, it is almost equally important to amend the imperfect laws of other States in order to render them more effective. The most striking defects of existing legislation have already been discussed, and, as suggested, they may be remedied best by securing greater uniformity. This may be accomplished—

(1) By extending the list of protected species to *all* birds other than game birds and a few specially excepted species.

(2) By removing all insectivorous birds from the game list.

(3) By reducing the list of species excluded from protection.

(4) By restricting special legislation, and as far as possible bringing all the counties in a State under one common law.

(5) By making proper provisions for collecting specimens for scientific purposes.

(6) By harmonizing the penalties for violations of the law.

As a suggestion of what a comprehensive law should be, the text of an act prepared by the American Ornithologists' Union is given in full below. This act was originally prepared and published early in 1886[1] by the Committee on Bird Protection, composed of ten active members of the Union, with the late George B. Sennett as chairman. While it can hardly be expected to meet the needs of all the States without change, it can easily be adapted to local requirements by making the necessary modifications, as suggested under the head of 'Remarks.' This act is not an experiment, for it has been tested in several States, has been adopted almost literally by Illinois and Indiana, and has been in force in the latter State for nearly ten years. Its main features have also been incorporated in the laws of Massachusetts, New York, and Rhode Island, and the provisions regarding permits in those of Colorado, Connecticut, Minnesota, New Jersey, Ohio, and Pennsylvania.

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[1] Supplement to Science, No. 160, February 26, 1886.

ACT PROPOSED BY THE AMERICAN ORNITHOLOGISTS' UNION.[1]

An Act for the protection of birds and their nests and eggs.

SECTION 1. No person shall, within the State of ———, kill or catch or have in his or her possession, living or dead, any wild bird other than a game bird, nor shall purchase, offer, or expose for sale any such wild bird after it has been killed or caught. No part of the plumage, skin, or body of any bird protected by this section shall be sold or had in possession for sale. For the purposes of this act the following only shall be considered game birds: The Anatidæ, commonly known as swans, geese, brant, and river and sea ducks; the Rallidæ, commonly known as rails, coots, mud-hens, and gallinules; the Limicolæ, commonly known as shore birds, plovers, surf birds, snipe, woodcock, sandpipers, tatlers, and curlews; the Gallinæ, commonly known as wild turkeys, grouse, prairie chickens, pheasants, partridges, and quails.

SEC. 2. No person shall, within the State of ———, take or needlessly destroy the nest or the eggs of any wild bird nor shall have such nest or eggs in his or her possession.

SEC. 3. Any person who violates any of the provisions of this act shall be guilty of a misdemeanor, and shall be liable to a fine of five dollars for each offense, and an additional fine of five dollars for each bird, living or dead, or part of bird, or nest and eggs possessed in violation of this act, or to imprisonment for ten days, or both, at the discretion of the court.

SEC. 4. Sections 1, 2, and 3 of this act shall not apply to any person holding a certificate giving the right to take birds and their nests and eggs for scientific purposes, as provided for in section 5 of this act.

SEC. 5. Certificates may be granted by [here follow the names of the persons, if any, duly authorized by this act to grant such certificates], or by any incorporated society of natural history in the State, through such persons or officers as said society may designate, to any properly accredited person of the age of fifteen years or upward, permitting the holder thereof to collect birds, their nests or eggs, for strictly scientific purposes only. In order to obtain such certificate the applicant for the same must present to the person or persons having the power to grant said certificate written testimonials from two well-known scientific men, certifying to the good character and fitness of said applicant to be intrusted with such privilege; must pay to said persons or officers one dollar to defray the necessary expenses attending the granting of such certificates; and must file with said persons or officers a properly executed bond, in the sum of two hundred dollars, signed by two responsible citizens of the State as sureties. This bond shall be forfeited to the State, and the certificate become void, upon proof that the holder of such a certificate has killed any bird, or taken the nest or eggs of any bird, for other than the purposes named in sections 4 and 5 of this act, and shall be further subject for each such offense to the penalties provided therefor in section 3 of this act.

SEC. 6. The certificates authorized by this act shall be in force for one year only from the date of their issue, and shall not be transferable.

SEC. 7. The English or European house sparrow (*Passer domesticus*) is not included among the birds protected by this act.

SEC. 8. All acts or parts of acts, heretofore passed, inconsistent with or contrary to the provisions of this act, are hereby repealed.

SEC. 9. This act shall take effect upon its passage.

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[1] The original wording of the sections 1 and 2 has been modified in accordance with suggestions made by Mr. William Dutcher, and approved by Mr. Witmer Stone, chairman of the committee on protection of North American birds. These sections have been recast and somewhat elaborated, the penalties combined as section 3, but the other sections have been merely renumbered.

REMARKS.

The accompanying law is calculated to protect our birds as effectually as any legislation can, and it is desirable if possible to obtain its passage as it stands.

It is, however, a well-known fact that in many of our States the act would not receive favorable consideration unless modified in several particulars.

* * * It is very desirable that this act be adopted in as nearly the present form as possible, and since revision by persons unfamiliar with bird protection is liable to seriously affect the force of the law, we offer the following suggestions regarding revision when it is unavoidable:

(1st) *Game birds.*—In many States doves are universally classed as game birds, and where the game laws cover their protection during a closed season they may be so classed in section 1 if necessary.

Reed birds and blackbirds may have to be treated in the same way in several States. Robins, flickers, and meadowlarks, however, should not be permitted to be classed as game.

(2d) *Cage birds.*—There is nothing in the law to prevent the keeping of foreign cage birds as canaries, etc.

To keep *native* birds alive for study, etc., a certificate must be secured as per section 5. This is necessary to prevent the traffic in live birds.

(3d) Other birds which may have to be excluded from protection—

Hawks and owls.—The prejudice against these birds is very strong, while the arguments in their favor are well known and conclusive. They should be protected if possible. If nothing better can be done, effect a compromise by excluding Cooper's hawk, goshawk, sharp-shinned hawk, and great horned owl, and protect the rest.

Crows may have to be denied protection; there is about as much evidence for as against them, however.

Shrikes, herons, gulls, and terns should by all means be protected.

(4th) Where it is absolutely necessary to exclude any birds from protection they may be added to section 7, so as not to alter the main text.

(5th) On no account omit sections 4, 5, and 6, as is done in some of the present laws.

With the restrictions placed upon holders of certificates there is no danger of improper persons obtaining them. A small number of birds are required for scientific purposes, and provision should be made for obtaining them as much as for shooting game birds. The fee should be abolished, if possible, and should on no account be more than $1. The age limit should, moreover, *not* be raised above fifteen years.

FEDERAL LEGISLATION.

During the last three years several bills for the preservation of birds have been considered by Congress. The most important of these are the 'Hoar bill,' the 'Teller bill,' and the 'Lacey bill,' all of which were introduced in the Fifty-fifth Congress, but failed to pass, and were reintroduced at the first session of the Fifty-sixth Congress. The Hoar bill was intended to restrict the traffic in birds and feathers, while the others were directed mainly toward the protection of game.

THE HOAR BILL.

The Hoar bill 'for the protection of song birds,' was first introduced in the Senate by Hon. George F. Hoar, of Massachusetts, March 14, 1898,[1] and referred to the Committee on the Judiciary. Ten days later, on March 24, it was reported by the committee, with amendments, and passed by the Senate.[1] It was supported by Senator Bacon, who submitted as his remarks the picturesque petition in the name of the birds which had been prepared by Senator Hoar and presented to the legislature of Massachusetts in support of the State act of 1897. (See pp. 11–12.) The bill, however, failed to pass the House before adjournment and was reintroduced in the Senate, in essentially the same form, early in the first session of the Fifty-sixth Congress, on December 12, 1899. It prohibits (1) importation into the United States; (2) transportation from one State to another; and, (3) sale within the Territories or the District of Columbia, of birds or feathers for ornamental purposes. This legislation was aimed directly against the feather trade, and naturally aroused the opposition of the millinery interests. The fear has also been expressed that the clause prohibiting the importation of foreign birds would result in an increased demand for native species, and hence increase, rather than diminish, the destruction of birds in this country. The prohibition of the sale of feathers relates only to Alaska, Arizona, New Mexico, Oklahoma, Indian Territory, and the District of Columbia, and even if strictly enforced here would have little effect so long as such sales were unrestricted elsewhere. The text of the bill as it now stands is as follows:

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[1] Cong. Record, XXXI, pt. 3, p. 2757.

A Bill (S. 1383) for the protection of song birds.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the importation into the United States of birds, feathers, or parts of birds for ornamental purposes, or for any purpose except for food, be, and the same is hereby, prohibited: *Provided, however*, That nothing herein contained shall be construed as prohibiting the importation of birds for museums, zoological gardens, or scientific collections, or the importation of living birds or of feathers taken from living birds without injury to the bird. The Secretary of the Treasury is hereby authorized to make regulations for carrying into effect the provisions of this section.

Sec. 2. That the transportation of birds, feathers, or parts of birds, to be used or sold, except such as are excepted in the first section of this Act, from any State or Territory of the United States to or through any other State or Territory of the United States, is hereby prohibited. Whoever shall violate the provisions of this section shall, upon conviction in the district where the offense shall have been committed, be punished for each such offense by a fine of fifty dollars.

Sec. 3. That the sale, keeping, or offering for sale, within any Territory of the United States, or within the District of Columbia, of birds, feathers, or parts of birds, for ornamental purposes, except such as are excepted in the first section of this Act, be, and the same is hereby, prohibited. Whoever shall violate the provisions of this section shall, upon conviction, be punished for each such offense by a fine of fifty dollars.

THE TELLER BILL.

The Teller bill, 'to regulate interstate traffic in wild game,' was first introduced in the Fifty-fifth Congress by Senator Henry M. Teller, of Colorado, on July 2, 1897,[1] and referred to the Committee on Forest Reservations and the Protection of Game. As originally prepared, it was intended merely to prevent the shipment of deer, elk, antelope, bison, or Rocky Mountain sheep from Colorado, Wyoming, and Utah. Under its provisions any person, railroad or express company, or other common carrier who received such game for transportation, unless the export was permitted by the laws of the State from which the shipment was made, was liable to a penalty of $100 to $1,000.[2] The bill was, however, materially modified a few months later, and reintroduced in the Senate on January 18, 1898. It was broadened so as to prohibit interstate traffic in game killed in violation of local laws from any State or Territory or the District of Columbia, and the game list was considerably extended by including certain specified game birds and 'other waterfowl,' so that it really covered a number of birds. The penalty was also changed so as to conform to section 10 of the Interstate-commerce Act.[3] The bill failed to pass, and was introduced for the third time early in the first session of the Fifty-sixth Congress, on December 15, 1899, and was referred to the Committee on Interstate Commerce. No changes were made in the wording, which was as follows:

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[1] Cong. Record, XXXI, pt. 3, p. 3166; Forest and Stream, L, p. 264, April 2, 1898.

A Bill (S. 1680) to regulate the shipment of wild game from one State to another.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be unlawful for any railroad company, express company, or other common carrier, or its officers, agents, or servants, to receive for shipment or transportation, or for any person or corporation to ship or offer to any common carrier for shipment, from any place within any of the States or Territories of the United States or District of Columbia, to any place without any of the States or Territories of the United States or District of Columbia, or to any foreign country, for sale, for market, or for storage, any moose, elk, deer, buffalo or bison, caribou, antelope, mountain sheep, or mountain goats, or any parts thereof, or any wild turkey, prairie chicken, or pinnated grouse, sage hen, Mongolian or ringneck pheasant, grouse, pheasant or partridge, quail, wild goose, duck, brant, swan, woodcock, snipe, rail, plover, or other waterfowl: *Provided*, That nothing herein contained shall prohibit the shipment of any wild game, animals, or birds, or parts of the same that may be expressly authorized or permitted by the laws of the State in and from which the shipment is made, if the same is conspicuously labeled "wild game," on which label shall be stated the kind and quantity of said wild game, animals, or parts of the same, and the date and place of shipment, and the name or names of both the consignor and the consignee, a copy of which label shall be kept on file by the common carrier at the place from which said wild game, animals, or birds, or parts of the same, are shipped.

SEC. 2. That any person or corporation guilty of violating the provision of this section shall, upon conviction, be punished as provided in section ten of the Act to regulate interstate commerce; and the Interstate Commerce Commission is hereby given jurisdiction in the matter of the transportation of game as in other matters affecting traffic between the States.

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[1] Cong. Record, XXX, pt. 2, p. 2198.

[2] Forest and Stream, XLIX, p. 328, October 23, 1897.

[3] Ibid., L, p. 81, January 29, 1898.

THE LACEY ACT.

The Lacey bill was first introduced in the House by Hon. John F. Lacey, of Iowa, on July 1, 1897.[1] Its object was to aid in the propagation and introduction of new or valuable birds, and the work was to be placed in charge of the United States Commission of Fish and Fisheries. The Commission was to be given authority to propagate, distribute, transport, or introduce game and other wild birds, and to collect and publish useful information in regard to them. In this form the bill passed the House on December 19, 1898,[2] but in the Senate it was amended by the addition of the Hoar bill, which had already been acted upon. On January 6, 1899, the combined Lacey-Hoar bill was passed and sent to conference,[3] but was not reported before adjournment.

At the opening of the Fifty-sixth Congress the Lacey bill was reintroduced in the House, but it had been changed so that the work was placed under the Department of Agriculture instead of under the Fish Commission, and interstate traffic in game in violation of State laws was restricted by a section very similar to that in the Teller bill. Again the bill was modified, was reintroduced on January 17, 1900, referred to the Committee on Interstate and Foreign Commerce, and favorably reported with an amendment by the committee on March 1. It was passed by the House by a vote of 141 to 27 on April 30,[4] and was supported by Representatives from thirty-four States. On the following day it was referred to the Senate Committee on Interstate Commerce, favorably reported on May 17, passed by the Senate without amendment on May 18,[5] and approved May 25, 1900.[6]

This act is the broadest and most comprehensive measure of its kind ever considered by Congress. It is intended to supplement existing State laws, and in regulating interstate commerce in game it will doubtless mark the beginning of a new era in bird protection. It contains three main provisions: (1) It places the preservation of birds under the jurisdiction of the Department of Agriculture; (2) authorizes the Secretary of Agriculture to regulate the importation of foreign birds and animals, and to prohibit the introduction of the mongoose, 'flying foxes,' English sparrow, starling, or other species which may be injurious; and, (3) prohibits interstate traffic in birds killed in violation of State laws. This latter feature was explained in the report of the House committee as follows:

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[1] Cong. Record, XXX, pt. 2, p. 2195; Forest and Stream, XLIX, p. 21, July 10, 1897.

[2] Ibid., XXXII, pt. 1, p. 318; Forest and Stream, LI, p. 509, December 24, 1898.

[3] Ibid., p. 439.

[4] This is the corrected vote, which was given on April 30 as 142 to 26. (See Cong. Record, XXXIII, pp. 5228, 5307, April 30 and May 1, 1900.)

[5] Ibid., XXX, p. 6151, May 18, 1900.

[6] Ibid., XXX, p. 6588, May 26, 1900.

> The most important purpose of this bill is to supplement the State laws for the protection of game and birds. * * * Where States are powerless to protect themselves, the National Government has ample power. This bill goes to the very root of this matter by forbidding interstate commerce in such animals and birds when killed or caught in violation of local laws. * * * Interstate commerce is beyond State control. The killing or carrying of game within the limits of a State is a matter wholly within the jurisdiction of the State, but when the fruits of the violation of State law are carried beyond the State, the nation alone has the power to forbid the transit and to punish those engaged in the traffic. This bill will give to the game wardens the very power that they now lack and which would be the most effective for the purpose of breaking up this commerce. The bill is supported by many persons and associations throughout the United States, and your committee are of the opinion that it will be of much aid in preventing the present rapid extermination of our game, song and insectivorous birds.[1]

The act reads as follows:

An Act (H. R. 6634) to enlarge the powers of the Department of Agriculture, prohibit the transportation by interstate commerce of game killed in violation of local laws, and for other purposes.[2]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the duties and powers of the Department of Agriculture are hereby enlarged so as to include the preservation, distribution, introduction, and restoration of game birds and other wild birds. The Secretary of Agriculture is hereby authorized to adopt such measures as may be necessary to carry out the purposes of this act and to purchase such game birds and other wild birds as may be required therefor, subject, however, to the laws of the various States and Territories. The object and purpose of this act is to aid in the restoration of such birds in those parts of the United States adapted thereto where the same have become scarce or extinct, and also to regulate the introduction of American or foreign birds or animals in localities where they have not heretofore existed.

The Secretary of Agriculture shall from time to time collect and publish useful information as to the propagation, uses, and preservation of such birds.

And the Secretary of Agriculture shall make and publish all needful rules and regulations for carrying out the purposes of this act, and shall expend for said purposes such sums as Congress may appropriate therefor.

SEC. 2. That it shall be unlawful for any person or persons to import into the United States any foreign wild animal or bird except under special permit from the United States Department of Agriculture: *Provided*, That nothing in this section shall restrict the importation of natural history specimens for museums or scientific collections, or the importation of certain cage birds, such as domesticated canaries, parrots, or such other species as the Secretary of Agriculture may designate.

The importation of the mongoose, the so-called "flying foxes" or fruit bats, the English sparrow, the starling, or such other birds or animals as the Secretary of Agriculture may from time to time declare injurious to the interest of agriculture or horticulture is hereby prohibited, and such species upon arrival at any of the ports of the United States shall be destroyed or returned at the expense of the owner. The

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[1] Fifty-sixth Congress, first session, House of Representatives, Report No. 474, to accompany H. R. 6634.

[2] Cong. Record, XXXIII, pp. 3868, 5228, April 2 and 30, 1900.

Secretary of the Treasury is hereby authorized to make regulations for carrying into effect the provisions of this section.

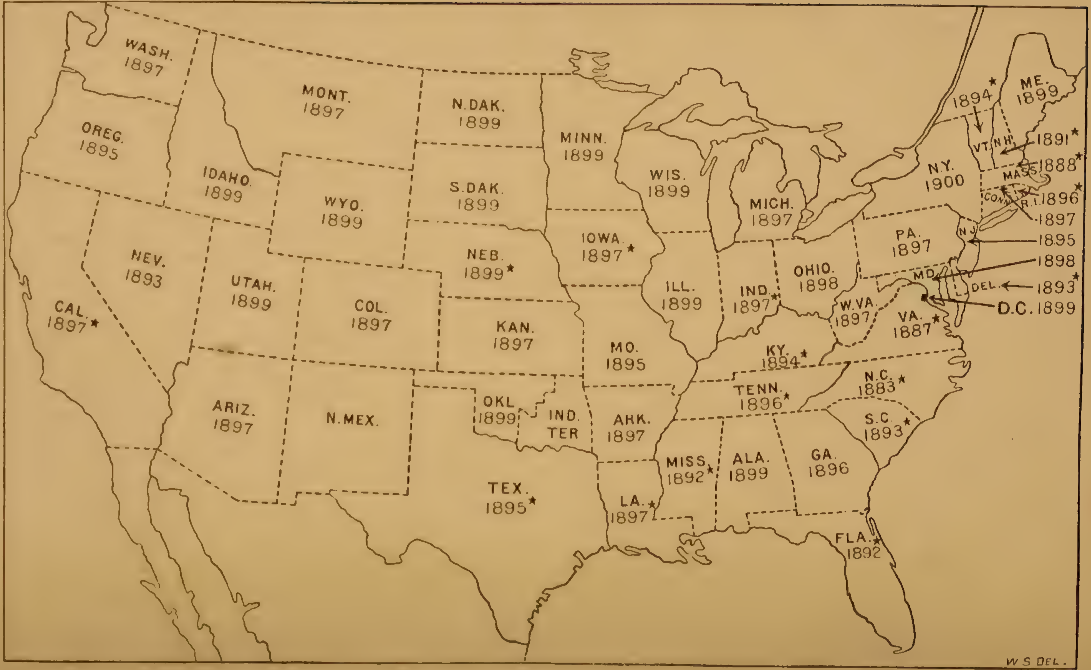
SEC. 3. That it shall be unlawful for any person or persons to deliver to any common carrier, or for any common carrier to transport from one State or Territory to another State or Territory, or from the District of Columbia or Alaska to any State or Territory, or from any State or Territory to the District of Columbia or Alaska, any foreign animals or birds the importation of which is prohibited, or the dead bodies or parts thereof of any wild animals or birds, where such animals or birds have been killed in violation of the laws of the State, Territory, or District in which the same were killed: *Provided*, That nothing herein shall prevent the transportation of any dead birds or animals killed during the season when the same may be lawfully captured, and the export of which is not prohibited by law in the State, Territory, or District in which the same are killed.

SEC. 4. That all packages containing such dead animals, birds, or parts thereof, when shipped by interstate commerce, as provided in section 1 of this act, shall be plainly and clearly marked, so that the name and address of the shipper and the nature of the contents may be readily ascertained on inspection of the outside of such packages. For each evasion or violation of this act the shipper shall, upon conviction, pay a fine of not exceeding $200; and the consignee knowingly receiving such articles so shipped and transported in violation of this act shall, upon conviction, pay a fine of not exceeding $200; and the carrier knowingly carrying or transporting the same shall, upon conviction, pay a fine of not exceeding $200.

SEC. 5. That all dead bodies, or parts thereof, of any foreign game animals, or game or song birds, the importation of which is prohibited, or the dead bodies, or parts thereof, of any wild game animals, or game or song birds transported into any State or Territory, or remaining therein for use, consumption, sale, or storage therein, shall upon arrival in such State or Territory be subject to the operation and effect of the laws of such State or Territory enacted in the exercise of its police powers, to the same extent and in the same manner as though such animals or birds had been produced in such State or Territory, and shall not be exempt therefrom by reason of being introduced therein in original packages or otherwise. This act shall not prevent the importation, transportation, or sale of birds or bird plumage manufactured from the feathers of barnyard fowl.

Approved May 25, 1900.

PLATE II.


WASH. 1897
OREG. 1895
CAL. 1897 *
NEV. 1893
IDAHO. 1899
MONT. 1897
WYO. 1899
UTAH. 1899
ARIZ. 1897
COL. 1897
N. MEX.
N. DAK. 1899
S. DAK. 1899
NEB. 1899 *
KAN. 1897
OKL. 1899
IND. TER
TEX. 1895 *
MINN. 1899
IOWA. 1897 *
MO. 1895
ARK. 1897
LA. * 1897
WIS. 1899
ILL. 1899
MISS. 1892 *
MICH. 1897
IND. * 1897
KY. * 1894
TENN. 1896 *
ALA. 1899
OHIO. 1898
W. VA. 1897
GA. 1896
FLA. * 1892
PA. 1897
VA. * 1887
N.C. 1883 *
S.C. 1893 *
N.Y. 1900
1894 *
ME. 1899
VT.
N.H.
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MAP SHOWING DATES OF RECENT STATE LAWS FOR THE PROTECTION OF BIRDS.

Asterisks (*) indicate that the laws are taken from the latest Code or Revised Statutes, and may have been enacted earlier. The laws of Arizona and Idaho apply only to game, those of Florida only to game and plume birds. Rhode Island now has a new law, passed May 4, 1900 (see p. 78).

II. STATE LAWS FOR THE PROTECTION OF BIRDS.

The following digest of measures for the protection of birds, which includes the latest acts passed in the various States up to the close of 1899, and also laws enacted by New York and Rhode Island in 1900,[1] fairly represents the legislation in force in the United States at the close of the century. In the fifty years that have elapsed since the enactment of the first law protecting insectivorous birds, considerable progress has been made, although much still remains to be accomplished. With the exception of Alaska (see p. 57), every State and Territory has its bird law, but Arizona, Idaho, Indian Territory, and New Mexico protect only game, and Florida only game and plume birds.

Uncertainties still surround many of the questions involved in these laws; but some fundamental principles have been definitely settled by decisions of the higher courts, the tendency of which is to give the fullest effect to such legislation. While these decisions relate primarily to game, the principles established apply equally to birds of all kinds. Several of the State courts have held that the title to game is vested in the State, and Colorado, Michigan, and Texas incorporate this principle in their laws, declaring in no uncertain terms that game is the property of the State. The supreme court of California has said, "The wild game within a State belongs to the people in their collective sovereign capacity. It is not the subject of private ownership except in so far as the people may elect to make it so, and they may, if they see fit, absolutely prohibit the taking of it, or traffic and commerce in it, if it is deemed necessary for the protection or preservation of the public good."[2] It is generally admitted that the State has the right to legislate regarding the protection of its birds and game; and the court of appeals of New York some years ago held that all game, whether killed within the State or imported from without, is subject to the State law, provided the wording of the statute covers it,[3] a principle which has recently been incorporated in the Minnesota game law.[4] In 1896, the Supreme Court of the United States[5] affirmed the principle of State ownership of game, and sustained the constitutionality of the law of Connecticut prohibiting the export of game from the State.

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[1] I am indebted to Mr. William Dutcher, of New York City, for copies of the New York and other recent laws, and to Mrs. Eleanor W. T. Smith, of Providence, for the Rhode Island law.

[2] *Ex parte* Maier, 103 Cal., 476. The same view was expressed by the supreme court of Minnesota in State *v.* Rodman, 58 Minn., 393.

[3] Phelps *v.* Racey, 60 N. Y., 10.

[4] Laws of 1897, chap. 221, sec. 32.

[5] Geer *v.* State of Connecticut, 161 U. S., 519.

This compilation has been made from the latest code or revision in each State, with such modifications as have been necessitated by subsequent legislation in order to bring it down to date. Only those sections relating to birds generally, as distinguished from game birds, have been quoted verbatim, while abstracts (inclosed in brackets) have been given of those that make provision for the issue of permits or licenses to scientific collectors, seasons for 'aquatic' or 'web footed wild fowl,' open seasons for birds improperly regarded as game, penalties for violations of the laws, export of birds in general, and kindred matters. Sections relating solely to game birds are not quoted.[1]

ALABAMA.[2]

General Laws of 1898-99, pp. 77-83.

Sec. 1. [Prohibits hunting or shooting on Sunday.]

Sec. 2. That no person in this State shall kill, wound, trap, net, snare, catch with birdline, or any similar substance, poison or drug, any bird of song or any warbler, linnet, titmouse, bluebird, sparrow, yellow bird, thrush, downy woodpecker, hairy woodpecker, pileated woodpecker, red-bellied woodpecker, red-[3] [headed woodpecker, cat bird, penee, vireo, mar-] *and every year, save as to the turtle dove which* tin, tanegar, tileup, blue finch, indigo bird, oriole, shrike, keldee, gnat catcher, snow bird, hair bird, grosbeck, whippoorwill, cuckoo, chenink, chickadee, chat, phoebe bird, red start, finch, humming bird, cow bird, shore lark, wren, swallow, robin, grackle, meadow lark, nuthatch, swift, nighthawk, starling or bunting, turtle dove, joree, red bird, mocking bird, American sparrow, field lark, or rain crow. Nor shall any person purchase or have in possession, or expose for sale, any of the aforesaid song or wild birds, or the game mammals killed or taken in this State except as hereinafter provided; but nothing herein shall be construed to prevent the keeping of song birds in cages as domestic pets. No person shall take or needlessly destroy the nest or eggs of any song or other wild bird except as hereinafter provided. This act shall not apply to any person holding a certificate giving the right to take birds and their nests and eggs and game mammals for scientific purposes in accordance with the following provisions [Certificates may be granted by the probate judge of any county to persons over 15 years of age. Applicants must pay $5 and file with said probate judge a properly executed bond in the sum of $100, signed by two responsible citizens of the State as sureties. Certificates shall be in force one year from date of issue and shall not be transferable]: *And, provided further*, That it shall be lawful to kill any bird so protected from the first day of November to the first day of March in each[3] [and every year, save as to the turtle dove which] *headed woodpecker, cat bird, penee, vireo, mar-* may be killed from August 1st to March 1st of each year, and, excepting the mocking bird which it shall be unlawful to kill at any time.

The English or European house sparrow, the king fisher, Cooper's hawk, sharp-shinned hawk, duck hawk, pigeon hawk, great horn owl, and barred owl, green heron and night heron, are not to be included among the birds protected by this act.

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[1] The sections of the Arizona law referring to doves are included since these birds do not come within the definition of game birds given on page 14.

[2] The spelling in the statute has been followed literally.

[3] To understand the intent of the law, read the two bracketed lines in place of the two italicized lines; the latter were evidently transposed in printing.

Any person or persons violating any of the provisions of this section shall, on conviction, be fined not less than ten dollars for each and every violation, or in default of payment thereof by imprisonment in the county jail for a period of one day for each dollar of penalty imposed: *Provided*, That any of such birds may be killed or otherwise destroyed when they eat or destroy strawberries, grapes, cherries or other fruits or vegetables.

SEC. 6. [No person shall at any time kill or have in possession any of the birds of this State with intent to ship the same beyond the State, and it shall not be lawful to transport beyond the limits of this State any of the game birds mentioned in this act.]

SEC. 9. Be it further enacted, Except as provided for in section 2, no person for any reason or purpose whatever, shall take, have in his or her possession or under control, break or destroy or in any manner interfere with any nest or the eggs therein of any of the kinds of birds, the killing of which is at any time or all time herein prohibited: *Provided*, That this does not apply to persons who have obtained certificates permitting them to collect the nests and eggs of wild birds other than game birds. Whosoever shall offend against any of the provisions of this section shall, on conviction, be fined not less than fifty dollars for each and every offense so committed, or by imprisonment in the county jail for a period of one day for each dollar of penalty imposed.

SEC. 14. * * * Provided, the provisions of this act shall not apply to the counties of Hale, Tuscaloosa, Marengo, Wilcox, Marion, Greene, Pickens, Coosa, Clay, Choctaw, Calhoun, Limestone, Clarke, Washington, Chambers, Lawrence, Coffee, Autauga, St. Clair, Franklin, Geneva, Walker, Randolph, Lowndes, Pike, Lauderdale, Butler, Bullock, Dale, Henry, Russell, Cleburne, Lee, Winston, Hale, Blount, Baldwin, Dallas, Chilton, Talladega, Escambia, Elmore, Lamar, Sumter, Fayette, DeKalb, Mobile, Bibb, Cherokee, Etowah, Marshall, Barbour, Jefferson, Tallapoosa, Shelby, Crenshaw, Colbert, Conecuh and Jackson, and it shall not apply to Montgomery county except in so far as game birds and mammals are concerned.

Approved February 8, 1899.

ALASKA.

[The code of Alaska is now before Congress. During the discussion in the House of Representatives on May 24, 1900, an amendment was made to section 29, prohibiting the shipment of eggs of cranes, brant, geese, or ducks.[1]]

ARIZONA.[2]

Acts of 1897, No. 41, pp. 77-78.

SEC. 3. [Every person who shall take, gather, or destroy the eggs of any dove or of certain game birds shall be guilty of a misdemeanor.]

SEC. 4. [Makes killing or possession of doves between March 1 and June 1 a misdemeanor.]

ARKANSAS.

Acts of 1897, Act XLI, p. 53.

SEC. 1. It shall be unlawful for any person within the State of Arkansas to kill, wound or injure any wild bird other than the game birds, or to destroy, disturb or rob the nests of any such birds, or to sell or expose for sale, either dead or alive, any of such birds, or to sell or expose for sale, any of the eggs of any such birds; and it shall be unlawful for any railroad company, express company, steamboat company, or other company or corporation or private person, their agents, employees or servants, to have in possession or receive for transportation or carriage, or for any other purpose whatever, any such birds or eggs; but this section shall not apply to English sparrows, crows, black birds, hawks, owls, eagles, and other birds of prey, nor shall it prohibit any person from killing any such birds on his own premises, when in the act of destroying fruit or other crops.

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[1] Cong. Record, XXXIII, p. 6419, May 24, 1900.

[2] This law provides only for the preservation of game birds, and in addition to doves protects quail, bob-white, partridge, grouse, wild turkey, snipe, rail, wild ducks, geese, and brant.

Approved March 15, 1897.

[This act amends section 3433 of the game law in Sandels & Hill's Digest, 1894, p. 847. The only game birds mentioned in that law are the wild turkey, pinnated grouse or prairie chicken and quail or Virginia partridge. The penalties for violations of this law are found in section 3436 of the Digest, which reads as follows:]

"SEC. 3436. Any person violating any of the provisions of this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than three, nor more than ten dollars for each bird killed, caught or injured, or had in possession * * * and not less than three dollars nor more than ten for each nest of eggs destroyed as aforesaid, together with the costs of prosecution."

Act February 23, 1885.

CALIFORNIA.

Penal Code, 1897, pp. 216,218.

SEC. 626. * * * Every person who shall take, gather, or destroy the eggs or nests of any * * * dove, robin, or any kind of wild duck, or rail; every person who, in the State of California, shall at any time hunt, shoot, shoot at, take, kill, or destroy, buy, sell, give away, or have in his possession, except for the purpose of propagation, or for educational or scientific purposes, any English skylark, robin, canary, humming-bird, thrush, or mocking-bird, or any part of the skin, skins, or plumage thereof, or who shall rob the nests or take or destroy, or offer for sale, the eggs of any of the said birds * * * is guilty of a misdemeanor; provided, however, that the right of possession for the purpose of propagation shall first be obtained by a permit in writing from the Board of Fish Commissioners of the State of California. Any person found guilty of a violation of any of the provisions of this section, shall be fined in a sum not less than twenty dollars or more than five hundred dollars, or be imprisoned in the county jail in the county in which the conviction shall be had, not less than ten days or more than one hundred and fifty days, or be punished by both such fine and imprisonment. [Killing of doves permitted between July 15 and February 15.]

SEC. 627. [Prohibits transportation of doves beyond limits of State, except for purposes of propagation, under penalty of a fine of $20–$500 or imprisonment 10–150 days, or both fine and imprisonment.]

Amendment approved March 9, 1897.

Penal Code, 1897, Appendix, p. 562.

BLUE CRANES.

SEC. 1. Any person or persons who shall willfully and knowingly shoot, wound, trap, snare, or in any other manner catch or capture any blue crane in the State of California, or shall knowingly take, injure, or destroy the nest of any white or blue crane, or shall take, injure, or destroy any blue crane's eggs, in the nest or otherwise, in said state, shall be deemed guilty of a misdemeanor, and upon conviction thereof before any justice of the peace of the township in which the offense shall have been committed, shall be fined in a sum not less than fifty dollars nor exceeding one hundred dollars, and cost of the action for each offense, or may be imprisoned not less than fifty days nor more than one hundred days, or by such fine and imprisonment as the judgment of the court may direct.

Approved March 16, 1889.

Penal Code, 1897, Appendix, p. 563.

SEA GULLS.

Sec. 1. Every person who willfully kills or destroys any of that species of sea birds known as gulls, within five miles of the town of Santa Monica, in Los Angeles county, is guilty of a misdemeanor.

Approved March 15, 1876.

COLORADO.

Laws of 1897, chap. 8, pp. 40–49.

Sec. 15. No person shall at any time kill, ensnare, net or trap any robin, lark, whip-poor-will, finch, sparrow, thrush, wren, martin, swallow, snowbird, bobolink, red-winged black bird, crow, raven, turkey buzzard, oriole, king bird, mocking bird, song sparrow or other insectiverous [sic] bird or birds or any pheasant, quail, ptarmigan or partridge. * * *

Sec. 31. [Provides for issue of certificates for collecting birds for scientific purposes only, by State forest, game and fish commissioner to any member of any natural history society or other scientific body organized for study of natural history or any person accredited by such society. Specimens collected under certificate can only be disposed of by exchange. Applicant must file with commissioner written testimonials certifying to his fitness from two well-known citizens, a properly executed bond in the sum of one hundred dollars, signed by two responsible persons of the State as sureties and must pay the sum of $5. Certificates shall be in force for only three months from date of issue and shall not be transferable.]

Sec. 48. Any person violating any of the provisions of this Act * * * shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in a sum not less than twenty-five dollars nor more than three hundred dollars, or imprisoned in the county jail not less than ten days, nor more than six months, or by both such fine and imprisonment; *Provided*, That the minimum penalty * * * for any violation of Sections 15 * * * of this Act, shall be ten dollars. The killing or otherwise taking of each bird * * * mentioned in this Act or the possession thereof in violation of this Act shall constitute a separate and distinct offense.

Approved April 16, 1897.

Laws of 1899, chap. 98, p. 188.

Division A, Sec. 16. All game and fish now or hereafter within this State not held by private ownership, legally acquired, and which for the purposes of this act shall include all the quadrupeds, birds and fish mentioned in this act, are hereby declared to be the property of the State, and no right, title, interest or property therein can be acquired or transferred, or possession thereof had or maintained except as herein expressly provided.

Sec. 18. As used in this act * * * the prohibition and restriction shall, where not specifically otherwise provided extend to and include every part of such game or fish, and a violation as to each individual animal or part thereof shall be a separate offense, and two or more offenses may be charged in the same complaint, information or indictment * * *

DIVISION B, SEC. 7. (4) The open season for * * * cranes and water fowls shall begin September 1 and end April 15 next ensuing, except in altitudes exceeding 7,000 feet above sea level, where the open season shall begin September 15.

(5) The open season for wild pigeons and doves shall begin July 15 and end September 30 next ensuing.

DIVISION G, SEC. 4. [Every person or officer violating any of the provisions of this act shall be punished by a fine of $10 to $500, or by imprisonment from ten days to six months, or by both fine and imprisonment.]

Approved April 27, 1899.

CONNECTICUT.

General Statutes, 1888, Title XLI, Chap. CLII, p. 558.

SEC. 2542. Every person who shall shoot, snare, or kill any eagle shall be fined not less than twenty-five nor more than fifty dollars, or imprisoned not more than thirty days. (Stat. 1883, chap. 67.)

Public Acts of 1897, Chap. XXIII, p. 756.

SEC. 1 [amending section 2535 and repealing section 2536 General Statutes, 1888]. Every person who shall kill, cage, or trap, or have in his possession, dead or alive, any bluebird, Baltimore oriole, purple finch, thrush of any kind, cat-bird, wren, martin, swallow, chimney swift, bobolink, robin, night-hawk, whip-poor-will, fly-catcher, warbler, scarlet tanager, vireo, nuthatch, creeper, humming bird, rose-breasted grosbeak, kinglet, titmouse, indigo bird, cedar bird, yellow bird, phebe, sparrow (except English sparrows), or any species of the woodpecker, chickadee, or any other of the song or insectivorous birds, or who shall destroy the nests or eggs of any of said birds, shall be fined one dollar for each bird so killed, caged, trapped, or had in possession, or nest or egg destroyed.

Approved March 15, 1897.

Public Acts of 1899, chap. 62, p. 1017.

SEC. 1. The president of the board of commissioners of fisheries and game shall have authority to issue to suitable persons licenses to take and kill birds which may be otherwise protected by law, except game birds, and the nests and eggs of such birds, for scientific purposes only.

SEC. 2. [Applicant must present certificate signed by an officer of the Hartford Scientific Society showing that said applicant is a proper person to be intrusted with a license, and must file with the commissioners a bond in the sum of two hundred dollars.]

SEC. 3. [Licenses shall be issued for one year, and upon such conditions as commissioners may prescribe.]

SEC. 4. [Applicants shall pay fee of one dollar for license.]

Approved April 19, 1899.

DELAWARE.

Revised Statutes, 1893, Chap. LV, p. 457 (Laws of Del., Vol. 17, chap. 507).

SEC. 1. [Permits killing of reedbirds between September 1 and February 1.]

SEC. 6. That it shall be unlawful for any person within this State at any time to take, kill or destroy (upon lands not owned by himself) any of the following birds, viz: Robin, bluebird, martin, swallow, mockingbird, thrush, wakeup, woodpecker, wren, whippoorwill, catbird, nighthawk, oriole, redbird, yellowbird, hummingbird, groundrobin, skylark, flicker, or sapsucker, or willfully to take or destroy the eggs or nest of any of the aforesaid birds, or any other birds except hawks, owls, crows and English sparrows. And if any person within this State shall at any time take, kill, or destroy any of the birds named in this section, and not excepted from the provisions thereof, or shall willfully take or destroy the eggs or nest of any of the said birds not excepted as aforesaid, such person shall be deemed guilty of a common nuisance, and upon conviction thereof before any justice of the peace in this State shall be fined one dollar ($1.00) for each and every bird, or nest, or eggs so taken or destroyed in violation of the provisions of this section.

Sec. 7. [Prohibits hunting on Sunday under penalty of a fine of $10.]

Passed April 9, 1885.

[Rev. Stat., 1893, Chap. LV, p. 463 (Laws of Del., vol. 19, chap. 137, sec. 1), prohibits shipment of robins out of State under a penalty of $5 for each bird so shipped.]

Passed April 20, 1891.

DISTRICT OF COLUMBIA.

30 Statutes at Large, p. 1012.

Sec. 1. [Permits shooting of reedbirds or ricebirds and marsh blackbirds on Tuesdays, Thursdays, and Saturdays between August 21 and February 1.]

Sec. 3. That no person shall expose for sale or have in his or her possession dead, at any time, any turkey buzzard, wren, bluebird, hummingbird, blue jay, robin or migratory thrush, wood or song robin, martin, mocking bird, swallow, oriole, red or cardinal bird, catbird, pewit, whip-poor-will, goldfinch, sapsucker, hanging bird, woodpecker, crow blackbird, or other insectivorous bird, save for scientific purposes upon permit from the Superintendent of Police of the District of Columbia, in accordance with such restrictions as the Secretary of the Smithsonian Institution may prescribe, and excepting the English sparrow; nor rob the nest of any wild bird of eggs or young or destroy such nest, except in the clearing of lands of trees or brush; nor trap, net, or ensnare any wild bird or water fowl mentioned in this chapter, or have in his possession any trap, snare, net, or illuminating device for the purpose of killing or capturing any * * * bird, under a penalty of five dollars for each * * * bird killed or captured, or bird's nest and eggs destroyed, and, in default, to be imprisoned in the workhouse not exceeding thirty days.

Sec. 7. [There shall be no shooting, or having in the possession in the open air the implements for shooting, on Sunday, under a penalty of not more than twenty dollars for each offense.]

Approved March 3, 1899.

FLORIDA.

Revised Statutes, 1892, p. 847.

Sec. 2755. Whoever wantonly destroys the nest, eggs, or young of any sea bird, or bird of plume in this State, on the land or coast, or in any of the seas, bays, rivers, creeks or harbors, or within a marine league of the coast of the State, shall be punished by fine not exceeding twenty dollars. (Chap. 3043, act March 2, 1877.)

Sec. 2756. Whoever, not being a citizen of the United States, kills any birds for the purpose of obtaining plumes therefrom, on any part of the coasts of Florida, or in any of the bays, rivers, creeks or harbors, or inland waters or prairies of the same, or within a marine league of the coast of the State, shall be punished by a fine not exceeding one hundred dollars. (Chap. 3149, act February 22, 1879.)

Revised Statutes, 1892, Appendix, chap. 4050, p. 992.

SEC. 1. That hereafter it shall be unlawful for any person to kill, in this State, for the purpose of sale or commercial traffic any of the following named plumed birds: That is to say any crane, egret, ibis, curlew or heron.

SEC. 2. That hereafter it shall be unlawful for any person to purchase, trade or traffic in any of the plumed birds hereinbefore mentioned, or for commercial purposes to purchase, trade or traffic in the plumes or pelfry of the said plumed birds of the State.

SEC. 3. That whoever shall violate any of the provisions of this act shall be guilty of a misdemeanor, and, upon conviction thereof, shall be fined in a sum not exceeding three hundred dollars, or imprisoned in the county jail not exceeding six months, at the discretion of the court.

Approved June 5, 1891.

GEORGIA.

Public Laws of 1896, Title VII, No. 68, p. 74.

SEC. 1. * * * It shall be unlawful for any person to shoot, trap, kill, ensnare, net or destroy in any manner * * * any insectivorous or singing bird, except English sparrows, crows, larks, rice birds, night-hawks, wheat birds and doves, between the fifteenth day of March and the first day of November. It shall also be unlawful to shoot, trap, kill, ensnare, net or in any manner destroy any dove between the fifteenth day of March and the fifteenth day of August. It shall also be unlawful for any person to remove from the nests, or in any manner destroy the eggs of any of the birds protected by this Act during the periods they are so protected. * * * It shall be further unlawful for any person to sell or offer for sale any game, bird or animal, or any part of either, whether dead or alive, that are protected by this Act during the periods so protected, and it shall be taken and deemed as *prima facie* evidence of a violation of the provision of this section for any person or persons to be found in possession of any of the animals or birds (or the eggs of birds) during the periods in which they are protected by this Act, and any person or persons who shall violate any of the provisions of this Act as enumerated in this section shall be guilty of a misdemeanor.

Approved December 22, 1896.

General Laws of 1898, Title VI, No. 13, p. 259.

SEC. 1. * * * That from and after the passage of this Act, the baiting or killing of doves thus baited, any season of the year, shall be a misdemeanor, and any person convicted thereof shall be fined not less than ten dollars nor more than fifty dollars.

Approved December 6, 1898.

ILLINOIS.

Laws of 1899, pp. 224-228.

SEC. 1. [Permits killing of mourning doves between September 1 and December 1.]

SEC. 3. Any person who shall, within the State, kill or catch or have in his or her possession, living or dead, any wild bird other than a game bird, English sparrow, crow, crow-blackbird or chicken hawk, or who shall purchase, offer or expose for sale any such wild bird after it has been killed or caught, shall, for each offense, be subject to a fine of five dollars for each bird killed or caught, or had in possession, living or dead, or imprisonment for ten days, or both, at the discretion of the court: *Provided,* That nothing in this section shall be construed to prevent the owner or occupant of lands from destroying any of such birds when deemed necessary by him for the protection of fruits or property. For the purposes of this act the following only shall be considered game birds: The An[a]tidæ, commonly known as swans, geese, brant and river and sea ducks; the Rallidæ, commonly known as rails, coots, mud-hens and gallinules; the Linicolæ [Limicolæ], commonly known as shore birds, plover, surf birds, snipe, wood-cock, sand-pipers, tatlers and curlews; the Gallinæ, commonly known as wild turkeys, grouse, prairie chickens, pheasants, partridges, quails, and mourning doves.[1]

Sec. 6. [Provides that this act shall not apply to the killing of birds by or for the use of taxidermists, for preservation either in public or private collections, if so preserved.]

Sec. 11. The ownership and title to all wild game and birds in the State of Illinois is hereby declared to be in the State. * * *

Sec. 13. Any person who shall, within the State of Illinois, take or needlessly destroy the nest or the eggs of any wild game or birds, or shall have such nest or eggs in his or her possession, shall be subject for each offense to a fine of five (5) dollars, or imprisonment for ten days, or both, at the discretion of the court.

Secs. 15 and 16. [Provide that certificates for collecting birds, nests and eggs for strictly scientific purposes may be granted by county clerks to persons 15 years of age or upwards. The applicant must present to the county clerk written testimonials certifying to his good character and fitness, from two well-known scientific men, must pay one dollar, and must file a properly executed bond, in the sum of two hundred dollars, signed by two responsible citizens of the State as sureties. Certificates shall be in force until the 1st of June following date of issue, and shall not be transferable.]

Approved April 24, 1899

INDIANA.

Thornton's Revised Statutes, 1897, pp. 361-362.

Sec. 2243. It shall be unlawful for any person to kill any wild bird other than a game bird, or purchase, offer for sale any such wild bird after it has been killed, or to destroy the nests or the eggs of any wild bird.

Sec. 2244. For the purpose of this Act the following only shall be considered game birds: the Anatidæ, commonly called swans, geese, brant, and river and sea ducks; the Rallidæ, commonly known as rails, coots, mud-hens, and gallinules; the Limicolæ, commonly known as shore birds, plovers, surf birds, snipe, woodcock, and sandpipers, tattlers, and curlews; the Gallinæ, commonly known as wild turkeys, grouse, prairie chickens, quail, and pheasants, all of which are not intended to be affected by this act.

Sec. 2245. Any person violating the provisions of section one [2243] of this Act shall, upon conviction, be fined in a sum not less than ten nor more than fifty dollars, to which may be added imprisonment for not less than five days nor more than thirty days.

Sec. 2247. [Provides for granting permits by the Executive Board of the Indiana Academy of Science to properly accredited persons for collecting birds, nests, and eggs for strictly scientific purposes. The applicant must present written testimonials from two well known scientific men certifying to his good character and fitness, must pay one dollar, and must file a bond in the sum of two hundred dollars, signed by at least two responsible citizens of the State.]

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[1] Mourning doves properly belong to the Columbæ, not to the Gallinæ.

Sec. 2248. [Provides that permits shall be in force only two years from date of issue, and shall not be transferable.]

Sec. 2249. The English or European house sparrow (*Passer domesticus*), crows, hawks, and other birds of prey are not included among the birds protected by this act.

Approved March 5, 1891.

IOWA.

Annotated Code, 1897, p. 888.

Sec. 2561. No person shall destroy the nests or eggs of, or catch, take, kill or have in possession or under control for any purpose whatever, except specimens for use of taxidermists, at any time, any whippoorwill, night-hawk, bluebird, finch, thrush, linnet, lark, wren, martin, swallow, bobolink, robin, turtle-dove, catbird, sandpiper, snowbird, blackbird, or any other harmless bird except bluejays and English sparrows, but nothing herein shall be construed to prevent the removal of nests from buildings, and the keeping of song birds in cages as domestic pets. Any person violating any of the provisions of this section shall be fined not less than one dollar nor more than twenty-five dollars and costs of prosecution, and may be committed to the county jail until such fine and costs are paid.

In effect October, 1897.

KANSAS.

Session Laws of 1897, chap. 135, p. 293.

Sec. 1. It shall be unlawful for any person or persons, at any time, except as hereinafter provided, to hunt, catch, kill, shoot, pursue, entrap or ensnare, any * * * oriole, meadow-lark, robin, thrush, redbird, mocking-bird, blue jay, turtle-dove, yellowhammer or bluebird: * * * *Provided furthermore*, That this act shall not prevent the owner of an orchard from shooting blue jays, orioles or yellowhammers at any time.

Sec. 4. The provisions of this act shall not apply to the catching or killing of any wild bird for the sole purpose of preserving it as a specimen for scientific purposes.

Sec. 6. [It shall be unlawful to buy, or sell, or offer for sale, or shipment, any bird or birds named in section 1.]

Sec. 7. It shall be unlawful for any railroad, express, or transportation company or corporation to accept, within the State of Kansas, for shipment or transfer, any of the birds mentioned in section 1 of this act.

Sec. 8. Any person, or the manager, agent or employee of any company or corporation found guilty of a violation of any of the provisions of this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof, before any court of competent jurisdiction, shall be fined in a sum not less than five dollars nor more than one hundred dollars, for each and every offense, and costs, together with an attorney's fee of ten dollars, and shall be committed until such fine, costs and attorney's fee shall be paid.

Approved March 13, 1897.

KENTUCKY.

Kentucky Statutes, 1894, pp. 718-719.

SEC. 1945. [Protects doves between February 1 and August 1.]

SEC. 1946. No person shall at any time catch, kill, or pursue with such intent, or have in possession after the same has been caught or killed, any thrush, meadowlark, finch, martin, swallow, woodpecker, flicker, oriole, red bird, tanager, cat-bird, blue-bird or other song or insectivorous bird, except where the same shall be destructive to the fruit or grain crops.

SEC. 1948. No person shall rob or destroy the nests or eggs of any wild bird whatsoever, save only those of a predatory nature, and destructive of other birds or fowls.

SEC. 1949. Any person guilty of violating any of the provisions of either of the preceding sections shall be fined for each offense not less than five nor more than twenty-five dollars.

SEC. 1952. [Unlawful killing, catching, or possession of each of the birds protected by this law shall constitute a separate offense, and two or more offenses may be joined in the same warrant or indictment.]

Act of February 27, 1894.

LOUISIANA.

Revised Laws, 1897, p. 247.

SEC. 4. That no person shall catch, kill or pursue, with such intent, or have in possession after the same has been caught or killed, any whippoorwill, sparrow, finch, oriole, bluebird, swallow, night hawk, or blackbird, except when the same shall be destructive to the fruit or grain crop, under a penalty of not less than five nor more than twenty-five dollars for each offense.

SEC. 5. That no person shall rob or destroy the nests or eggs of any wild bird whatsoever, save only those of a predatory nature, and destructive of game or insectivorous birds, under a penalty of not less than five nor more than twenty-five dollars for each offense.

SEC. 6. That no person shall entrap, net, kill, or pursue with such intent, or have the same in possession at any time during the year, any song bird, especially the mocking bird, except domesticated birds, except the birds be entrapped or netted for the purpose of domestication, under a penalty of not less than five nor more than twenty-five dollars for each offense, except when the same shall prove destructive to the fruit or grain crops.

SEC. 14. That all acts and violations of this law denominated as offenses in the foregoing sections shall be and are hereby declared to be crimes against the State of Louisiana, and it shall be the duty of all district attorneys and district attorneys *pro tempore* of the State to prosecute before any court of competent jurisdiction all offenders and persons committing misdemeanors under the provisions of this Act. (Act 60, Extra session 1877, p. 100.)

[Act of 1900 protects doves from April 1 to September 1.]

MAINE.

Public Laws of 1899, chap. 42, pp. 35-36.

SEC. 12. Whoever kills, or has in his possession, any birds commonly known as larks, robins, swallows, sparrows, woodpeckers or orioles, or other insectivorous birds, crows, English sparrows and hawks excepted, forfeits not less than one dollar, nor more than five dollars, for each such bird killed; and the possession by any person of such dead bird, is prima facie evidence that he killed such bird. Whoever at any time wantonly takes or destroys the nest, eggs or unfledged young of any wild bird, except crows, hawks, herons, loons and owls, or takes any eggs or young from such nests forfeits not less than one dollar nor more than ten dollars, for each nest, egg or young so taken or destroyed. Whoever carries or transports from place to place, any of the birds named in this chapter during the period in which the killing of such bird is prohibited, forfeits five dollars for each bird so carried or transported.

SEC. 14. [The commissioners of inland fisheries and game may issue licenses to taxidermists of good reputation and to suitable persons, not exceeding 10 at one time, to collect birds, nests and eggs for scientific purposes. Applicants shall pay $5 for licenses and can only dispose of specimens obtained under such permits by exchange, under a penalty of $10 to $50. Licenses do not authorize collecting on Sunday.]

SEC. 22. [Sunday is a close time, in which it is unlawful to hunt, kill, or destroy birds of any kind.]

Approved March 8, 1899.

Public Laws of 1899, chap. 116, p. 119.

No person shall kill or have in his possession, except alive, any bird commonly known as tern. Whoever violates provisions of this act shall be subject to a fine of not less than one dollar nor more than ten dollars.

Approved March 17, 1899.

MARYLAND.[1]

Laws of 1898, chap. 206, pp. 709–713.

SEC. 15B. [Permits killing of doves between August 15 and December 24.]

SEC. 15D. [Permits shooting of reedbirds between September 1 and November 1.]

SEC. 15E. [Permits sale of flickers in Baltimore between August 15 and December 24.]

SEC. 15H. No person shall, in this State, at any time shoot or in any manner catch or kill, expose for sale, sell or buy, or have in possession, alive or dead, any turkey-buzzard, wren, sparrow, bluebird, humming bird, bluejay, migratory or other thrush, wood robin, red breasted robin, martin, mocking bird, cat bird, swallow, oriole, red bird, lark, indigo bird, joe wink, pewitt, sapsucker, whippoorwill, gold finch, yellow-breasted chat, cedar bird, herring gull or mackerel gull, or gull of any description, under a penalty of not less than one ($1) dollar nor more than five ($5) dollars for each such bird so shot, caught, killed, exposed for sale, sold, bought or had in possession; and no person shall, under like penalty, have in his or her possession, offer for sale or wear, the skins, plumage, wings, or feathers of any of the birds, the catching or killing of which is prohibited by this section; provided, however, that nothing herein contained shall be so construed as to make it unlawful to shoot, catch or kill, or in any manner destroy, at any time, any hawk or other birds destructive to domestic poultry, or any English sparrow, or crow, or blackbird; provided, that this section shall not apply to St. Mary's County and Calvert County; provided, that it shall be lawful to have mocking birds or red birds, or other songbirds in cages, or stuffed specimens of any said birds in educational institutions, or public or private museums.

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[1] "NOTE.—The old County acts in regard to song and insectivorous birds * * * except in St. Mary's County and Calvert County * * * have been repealed and the State law is now in force over the entire State."—Maryland Game and Fish Protective Association, Game Laws, 1898, p. 124.

SEC. 15O. No person shall, in this State, at any time, molest or destroy the nests or eggs of any of the aforesaid birds, except those of hawks or other birds destructive to domestic poultry and game birds, or those of English sparrows, crows and blackbirds, under a penalty of not less than one nor more than five ($5) dollars nor more than twenty-five ($25) for each and every such offense.

SEC. 15R. [Provides for issue of certificates by State Game Warden to persons over 18 years of age, for killing birds or collecting eggs for purely scientific purposes, provided application and affidavit have been filed with the warden.]

Approved April 9, 1898.

MASSACHUSETTS.

Supplement Public Statutes, 1888, chap. 276, p. 435.

SEC. 2. Whoever takes or kills * * * a wild or passenger pigeon, or a gull, or a tern, between the first day of May and the first day of October, shall be punished by a fine of ten dollars for every bird so taken or killed.

SEC. 4. Whoever takes or kills any wild or undomesticated bird not named in sections one and two [the species there named are pinnated grouse, woodcock, ruffed grouse, quail, ducks, plover, snipe, sandpiper, rail, shore birds, wild pigeon, gull and tern] except English sparrows, crow blackbirds, crows, jays, birds of prey, wild geese, and such fresh water and sea fowl as are not named in sections one and two, or wilfully destroys, disturbs or takes a nest or eggs of any wild or undomesticated birds, except of the birds herein exempt from protection, shall be punished by a fine of ten dollars: *Provided*, That any person above the age of twenty-one years having a certificate from the game commissioners or from the president of the Boston Society of Natural History to the effect that such person is engaged in the scientific study of ornithology or collecting in the interest of a scientific institution, may take the nests and eggs of, or at any season take or kill, any undomesticated bird, except woodcock, ruffed grouse and quail. * * * *And provided further*, That the game commissioners and the president of the Boston Society of Natural History may at any time revoke any certificate they have respectively issued.

Act of June 10, 1886.

Acts and Resolves of 1897, chap. 140, p. 102.

CAPE ANN.

Whoever takes or kills * * * any land bird, except the English sparrow, within the limits of that section of this Commonwealth bounded by Squam river, Ipswich bay, the Atlantic ocean, Massachusetts bay and Gloucester harbor, at any time within five years from the passage of this act, shall be punished by a fine of twenty dollars for every * * * bird so taken or killed.

Approved March 8, 1897.

Acts and Resolves of 1898, chap. 339, p. 275.

SEC. 1 [chap. 524, Acts of 1897, amended to read:] Whoever has in his possession the body or feathers of any bird whose taking or killing is prohibited by section four of chapter two hundred and seventy-six of the acts of the year eighteen hundred and eighty six [=chap. 276, Pub. Stat., 1888], whether taken in this Commonwealth or elsewhere, or wears such feathers for the purpose of dress or ornament, shall be punished as provided in said section: *Provided*, That this act shall not be construed to prohibit persons having the certificate provided for in said section from taking or killing such birds; *and provided further*, That this act shall not apply to natural history associations or to the proprietors of museums, or other collections for scientific purposes, nor to nonresidents of the Commonwealth passing through it or temporarily dwelling within the limits thereof.

Approved April 14, 1898; in effect April 1, 1899.

Acts and Resolves of 1899, chap. 116, p. 57.

[Every Lord's day shall be close season. Whoever hunts or destroys birds or game of any kind on this day, shall be liable to the penalties imposed for violation of the law in other close seasons, in addition to those for shooting on the Lord's day.]

Approved March 1, 1899.

MICHIGAN.

Public Acts of 1893, No. 196, pp. 312-314.

Sec. 1. That no person shall at any time or in any manner acquire any property in, or subject to his dominion or control, any of the birds, game or fish, the killing, taking, or having in possession of which is at any time or at all times prohibited by any of the laws of this State, that they shall always and under all circumstances and conditions be and remain the sole property of the State. * * * When their killing is not prohibited by law, the same may be used at the time, in the manner, and for the purposes expressly authorized by law, but not otherwise.

Sec. 2. [No person, company or corporation shall at any time take, kill or have in possession with intent to ship beyond the limits of the State any of the birds the killing of which is at any time or all times prohibited by law, or shall ship, allow or aid in their shipment out of the State.]

Sec. 5. [Sale or possession of birds during close seasons prohibited. But nothing in this act shall prevent the taking or catching alive of birds for domestication, propagation, or breeding purposes.]

Sec. 6. [Any person violating any of the provisions of this act shall be punished by a fine of $10–$50, or imprisonment not exceeding 30 days.]

Approved June 1, 1893.

Public Acts of 1897, No. 159, p. 202.

Sec. 14 [(as amended by Acts of 1899, p. 80.) Protects "wild ducks * * * or other wild water fowl" between February 1 and August 31, except in Upper Peninsula, where the close season is January 16 to August 31. It also protects wild pigeons at all times until 1905, and thereafter from December 1 to October 19.]

Sec. 17. No person or persons shall at any time or in any manner whatever injure or destroy or rob the nest, or take, injure, destroy or have in possession the eggs of any bird the killing of which is at any time or at all times prohibited by law, nor shall any person or persons at any time or in any manner whatever, molest, harass or annoy such birds while on their nesting places.

Sec. 19. [Provides for the protection of pigeon roosts until after 1905.]

Sec. 20. No person or persons shall at any time or in any manner whatever injure, kill or destroy, or attempt to injure, kill or destroy, any robin, night hawk, whip-poor-will, finch, thrush, lark, swallow, yellow bird, blue bird, brown thresher, cat bird, wren, martin, oriole, sea gull, woodpecker, bobolink, or any song bird or insectivorous bird excepting black bird, blue jay, English sparrows and butcher bird.

Sec. 21. The term "game bird" used in this act shall be construed to mean all birds named or referred to except those mentioned and referred to in section twenty.

Sec. 27. [State game and fish warden authorized to issue permits in writing for collecting birds for scientific or propagating purposes. Such permits are not transferable.]

Sec. 29. The injuring, destruction or killing of each animal and bird injured, captured, killed or destroyed contrary to the provisions of this act shall be a separate offense, and the person so offending shall be liable to the penalties and punishments herein provided for each such offense.

Sec. 30. Any person or persons violating any of the provisions of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not less than ten dollars and not exceeding one hundred and twenty-five dollars, and costs of prosecution, or by imprisonment in the county jail not less than thirty days and not exceeding six months, or by both such fine and imprisonment in the discretion of the court.

Approved May 26, 1897.

Public Acts of 1899, No. 238, p. 374.

Sec. 1. That hereafter no person or persons shall pursue, injure, kill or attempt to kill, capture or attempt to capture by any means whatever, any mourning dove within the limits of this State.

Sec. 2. [Any person or persons violating any of the provisions of this act shall be punished by a fine of $5–$100 or by imprisonment for 10 to 90 days, or by both fine and imprisonment.]

Approved June 15, 1899.

MINNESOTA.

General Laws of 1897, chap. 221, pp. 413-427.

Sec. 10 (as amended by Gen. Laws of 1899, chap. 242, p. 275). No person shall catch, take, kill or have in possession or under control, for any purpose whatever, at any time, any whippoorwill, night hawk, bluebird, finch, thrush, linnet, lark, wren, martin, swallow bobolink, robin, catbird, or any other harmless bird, except blackbirds, crows, hawks and English sparrows, except as hereinafter allowed (but nothing herein contained shall be construed to prevent the keeping of song birds as domestic pets). It shall be unlawful, and is prohibited, to catch, take, kill, or have in possession or ship any turtle dove * * * between the first day of November and the first day of September following; * * * wild ducks * * * or any variety of aquatic fowl whatever, between the first (1st) day of January and the first (1st) day of September following. * * * Whoever shall offend against any of the provisions of this section shall be guilty of a misdemeanor, and, on conviction thereof, shall be punished by a fine of not less than ten (10) dollars nor more than twenty five (25) dollars and costs of prosecution or by imprisonment in the county jail for not less than ten (10) days nor more than thirty (30) days for each and every bird so caught, taken or killed, shipped or had in possession or under control.

Sec. 11. No person, for any reason or purpose whatever, shall take or have in possession or under control, break up or destroy, or in any manner interfere with any nest, or the eggs therein, of any of the kinds of birds the killing of which is at any or all times herein prohibited.

Any person offending against any provision of this section shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than ten (10) dollars nor more than one hundred (100) dollars and costs of prosecution, or by imprisonment in the county jail for not less than ten (10) days nor more than ninety (90) days.

Sec. 12. No person shall at any time catch or kill any of the birds permitted to be killed by this act at any time in any other manner than by shooting them with a gun held to the shoulder of the person discharging the same.

No person shall at any time set, lay or prepare any trap, snare, net, birdlime, swivel gun or any contrivance or device whatever with intent to catch, take or kill any of the birds in this act mentioned * * * [under same penalty as provided for violation of section 11.]

Sec. 13. [No person shall at any time catch, take, kill or have in possession any of the birds mentioned in this act with intent to ship them out of this State, under penalty of a fine of $10–$25 or imprisonment of 10–30 days for each and every bird had in possession.]

Sec. 32. No person shall at any time have in possession or under control in this State any bird, animal or fish caught, taken or killed outside of this State at a time when it is unlawful to have in possession or under control such birds, animals or fish when caught, taken or killed in this State [under penalty of a fine of $10–$50 or imprisonment of 10–60 days for each and every bird had in possession].

Sec. 41. [Certificates for collecting birds, nests, and eggs for scientific purposes may be granted by the board of game and fish commissioners to any member of any incorporated society of natural history or other scientific body organized for the study of natural history, or to any properly accredited person designated by such society; but specimens thus collected can only be disposed of by exchange. Applicants must file with the board of game and fish commissioners written testimonials, as to good character and fitness, from two well known scientific men; a properly executed bond of $100 signed by two responsible freeholders of the State as sureties; and must pay said board the sum of two dollars. Such certificate to be in force for 1 year from date of issue, and not transferable. Penalty for violation of this section a fine of not less than fifty (50) dollars or imprisonment in county jail for sixty (60) days or both.]

Approved April 23, 1897.

MISSISSIPPI.

Annotated Code, 1892, pp. 346, 538.

[Sec.] 1134. If any person shall at any time shoot, wound, injure, kill, catch, or pursue with such intent, a mocking-bird, or cat-bird, or thrush; or shall destroy or rob the nest of any wild bird whatever, except crows, black-birds, English sparrows, blue jays, hawks, owls, and other birds of prey, he shall be guilty of a misdemeanor, and, on conviction, shall be fined not less than one dollar nor more than ten dollars, or be imprisoned in county jail not exceeding ten days.

[Sec.] 1135. If any person shall shoot, wound, injure, kill, catch or pursue with such intent, any deer, or any turtle-dove (sometimes called mourning dove), or any starling (commonly called field-lark), between the first day of March and the fifteenth day of September, or any wild turkey, or any quail (usually called partridges), between the first day of May and the first day of October, in any year, he shall be guilty of a misdemeanor, and, on conviction, shall be punished by fine not less than five dollars nor more than twenty-five dollars, or be imprisoned in the county jail not exceeding thirty days; but this section, so far as it relates to deer and wild turkeys, shall not apply to the counties of Calhoun, Clarke, Covington, Greene, Jasper, Jones, Marion, Newton, Perry, Pearl-River, Simpson, and Smith. (Laws 1882, p. 146; Laws 1884, p. 129.)

[Sec.] 1136. If any person, save in the counties named in the last section, shall have in his possession, or shall sell or buy, or offer or expose for sale, or receive for transportation or carriage, or on deposit, or for sale, or for any other purpose, any of the eggs of any wild bird, except those in the section next before the last excepted, * * * during the period in which it is made unlawful to kill such animal or birds, he shall on conviction, be fined not less than one dollar nor more than twenty-five dollars. (Laws 1882, p. 91.)

[Sec.] 2118. The term "game" includes all kinds of animals and birds found in the state of nature, and commonly so called; * * *

[Sec.] 2119. The boards of supervisors are given full jurisdiction and authority for the protection and preservation of game and fish in their respective counties, and to conserve the same for the use and consumption of the inhabitants.

Secs. 2120, 2121. [Boards of supervisors authorized to regulate times and places in which game may be taken, and to adopt such regulations, not contrary to law, as they deem necessary for the protection of game in their counties.]

Sec. 2123. [Boards of supervisors may entirely prohibit the taking of any species of game for one or more years or seasons when they believe that the species of game is about to be destroyed or become extinct.]

MISSOURI.

Laws of 1895, p. 182.

Sec. 1. * * * It is further declared unlawful to kill any wild song bird or insectivorous bird at any season of the year, or to disturb, rob or destroy the nests of such birds, or take therefrom any egg or eggs. [Killing of turtle doves and meadowlarks permitted between August 1 and January 1.] * * * And any person offending against any of the provisions of this section shall be deemed guilty of a misdemeanor, and subject to a fine of not less than ten dollars nor more than fifty dollars.

Approved April 8, 1895.

MONTANA.

Laws of 1897, p. 251.

Sec. 7. Every person, who, wilfully shoots, or otherwise kills or causes to be killed, any meadow lark, blue bird, thrush, oriole, woodpecker, mocking bird, gold-finch, snow-bird, cedar-bird, stork, or any other of the small birds known as singing birds, shall be punishable by a fine not exceeding One Hundred Dollars, nor less than five Dollars and by imprisonment in the county jail not to exceed three months, or by both such fine and imprisonment.

Sec. 9. Any person who shall wilfully destroy the nests or carry away the eggs from the nests of any of the birds or wild fowls mentioned in this Act, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in any sum not less than Five Dollars nor more than Twenty five Dollars for each offense committed, or by imprisonment in the county jail for a period of not exceeding sixty days, or both, at the discretion of the court.

Sec. 25. None of the Sections of this Act shall apply to persons hunting or otherwise engaged in collecting specimens under the direction of, and in the interest of any State Educational Institution of the State of Montana.

Approved March 8, 1897.

NEBRASKA.

Compiled Statutes, 9th ed., 1899 (Criminal Code, Chap. XI), p. 1384.

Sec. 6736. It shall be unlawful for any person in the State of Nebraska to knowingly and intentionally kill, injure, or harm, except upon the lands owned by such person, any robin, lark, thrush, bluebird, king bird, sparrow, wren, jay, swallow, turtle dove, oriole, wood pecker, yellow hammer, cuckoo, yellow bird, bobolink, or other bird or birds of like nature, that promote agriculture and horticulture, by feeding on noxious worms and insects, or that are attractive in appearance or cheerful in song. Any person violating any of the provisions of this section shall be fined not less than three nor more than ten dollars for each bird killed, injured, or harmed.

NEVADA.

Statutes of 1893, Chap. XLIX, p. 49.

SEC. 1. It shall be unlawful for any person or persons, firm, company, corporation or association, to kill, destroy, wound, trap, snare, injure or in any other manner to catch, or capture, or to pursue with such intent, any sparrow, bluebird, bluejay, martin, thrush, mocking-bird, redbreast, cat-bird, wren, robin, meadow-lark, or humming-bird, or any song bird, except linnets, within this State, or who shall take, injure or destroy the nest or eggs of said before mentioned birds.

SEC. 2 [(as amended by Statutes of 1895, Chap. LVIII, p. 55). Makes it unlawful to kill sand hill cranes between April 1 and September 15, or bitterns and yellow hammers between March 15 and September 15.]

SEC. 6. * * * *Provided*, that nothing in this Act shall be so construed as to prohibit any person or persons, firm, company, corporation, or association, taking any bird, fowl, or animal mentioned in this Act, at any time, for scientific purposes.

SEC. 7. Any person or persons, firm, company, corporation, or association, or common carrier, or the agent of any such firm, company, corporation, or association, or common carrier, violating any of the provisions of this Act shall be deemed guilty of a misdemeanor, and upon conviction be fined in any sum not less than twenty-five ($25) dollars, nor more than two hundred ($200) dollars, or imprisonment in the county jail of the county in which said conviction is had, for any term not exceeding six months, or by both such fine and imprisonment, and in addition to the costs now allowed by law on criminal prosecution, twenty-five ($25) dollars liquidated damages, shall be entered up as costs against each defendant, and * * * shall be paid to the party instrumental in securing the arrest and conviction of said defendant.

Approved February 27, 1893.

NEW HAMPSHIRE.

Public Statutes, 1891, chap. 132, p. 365.

SEC. 1. If any person shall, at any season of the year, take or destroy any robin, thrush, lark, bluebird, sparrow (except English sparrows), finch, bunting, martin, oriole, swallow, flycatcher, warbler, tanager, bobolink, vireo, nuthatch, creeper, woodpecker, humming-bird, or any other of the song or insectivorous birds, he shall be fined five dollars for each bird so taken or destroyed, or be imprisoned not exceeding thirty days, or both.

SEC. 6. If any person shall designedly take from the nest and destroy the eggs or young of robins, thrushes, larks, bluebirds, sparrows (except English sparrows), martins, woodpeckers, bobolinks, yellow-birds, linnets, flycatchers, warblers, * * * or wild pigeons, he shall forfeit and pay, for every egg or young of any of said birds so taken and destroyed, the sum of two dollars.

SEC. 9. The provisions of this chapter shall not apply to the collecting of specimens for the cabinet of an educational institution by the curator thereof, or by or under his direction.

Laws of 1899, chap. 44, p. 279.

SEC. 1. If any person shall, for a period of three years from and after the passage of this act, kill any American or bald eagle he shall be punished by a fine of forty dollars for each bird so killed, or be imprisoned not exceeding three months, or both.

Approved March 8, 1899.

NEW JERSEY.

General Public Laws of 1895, Chap. CCLV, pp. 476–478.

SEC. 5 [(as amended by Laws of 1898, chap. 94). Permits killing of reedbirds between August 25 and January 1.]

SEC. 6 [(as amended by Act of April 14, 1896). Permits killing of doves in August and September.]

SEC. 7. That it shall be unlawful to capture, kill or injure or have in possession after the same have been captured, killed or injured, any night hawk, whip-poor-will, thrush, meadow lark, finch, martin, barn swallow, woodpecker, robin, oriole, red or cardinal bird, cedar bird, tanager, or other insectivorous bird, under a penalty of twenty dollars for every bird so captured, killed, injured or had in possession; *Provided*, That nothing in this section shall be so construed as to prevent the taking or killing of English sparrows, cranes, hawks, crows, ravens, crow-blackbirds, kingfishers or red-winged black birds.

SEC. 8. That it shall be unlawful to rob or destroy the eggs or nests of any wild bird whatever, under a penalty of twenty dollars for each and every nest so robbed or destroyed.

SEC. 11. That it shall be unlawful to catch, kill or injure, or to have unlawfully in possession after the same has been caught, killed or injured, any goose, duck, brant or other web-footed wild fowl, excepting only between the thirtieth day of September[1] and the first day of May, inclusive, in each and every year, under a penalty of twenty dollars for every goose, duck, brant or other web-footed wild fowls caught, killed, injured or had unlawfully in possession. [The term "other web-footed wild fowls" includes gulls, terns, etc.]

SEC. 15. [That it shall be unlawful to hunt with a gun or with a dog, or to carry a gun in the fields or woods on Sunday.]

SEC. 16. That nothing in this act shall be construed to prevent associations or individuals from domesticating or bringing into this State any animals or birds for the purpose of propagating the same, or keeping the same until a seasonable opportunity offers for their release.

SEC. 47. [Provides that in case of second conviction penalty shall be doubled.]

Approved March 22, 1895.

Laws of 1899, chap. 180, p. 483.

SEC. 1. A certificate may be granted by the New Jersey board of fish and game commissioners to any properly accredited person of the age of eighteen years or upward, permitting the holder thereof to collect birds and their nests and eggs for strictly scientific purposes only.

SEC. 2. [Applicant must present written testimonials from two scientific men, certifying to his good character and fitness; must pay fee of one dollar; and must file with said board a properly executed bond in the sum of two hundred dollars, signed by two property holders of the State.]

SEC. 3. [Certificates shall be in force one year from date of issue and shall not be transferable.]

SEC. 4. This act shall take effect immediately.

Passed March 24, 1899.

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[1] Open season changed to September 1 to May 1 by Laws of 1900, chap. 73, sec. 5.

NEW YORK.

Laws of 1900, chap. 20.

SEC. 20. Web-footed wild fowl shall not be taken or possessed from April thirtieth to August thirty-first, both inclusive [on Long Island from May first to September thirtieth, both inclusive, sec. 103]; or taken in the night from an hour after sunset until an hour before sunrise.

SEC. 30. [Grebes and bitterns shall not be killed from May 1 to August 31, both inclusive. (On Long Island grebes shall not be taken from December 31 to August 15, both inclusive, sec. 105, and bitterns from January 1 to June 30, both inclusive, sec. 108.)]

SEC. 33. Wild birds other than the English sparrow, crow, hawk, crane, raven, crow-blackbird, common blackbird, kingfisher, and birds for which there is an open season, shall not be taken or possessed at any time, dead or alive, except under the authority of a certificate issued under this act. No part of the plumage, skin, or body of any bird protected by this section shall be sold or had in possession for sale.

SEC. 34. Nests of wild birds other than the English sparrow, hawk, crane, crow, raven, crow-blackbird, common blackbird, or kingfisher, shall not be robbed or willfully destroyed except when necessary to protect buildings or prevent their defacement.

SEC. 36. [Certificates for collecting birds, nests, or eggs for scientific purposes may be granted by any society of natural history incorporated in the State, or by the regents of the University of the State of New York, to any properly accredited person of eighteen years of age or upward. The applicant for such certificate must present written testimonials as to his good character and fitness from two well-known scientific men. Applicants, except officers of the New York State Museum, must pay one dollar and must also file a properly executed bond in the sum of two hundred dollars, signed by two responsible and approved sureties. Certificates shall be in force for only one year from date of issue and shall not be transferable.]

SEC. 38 (as amended by chap. 604, laws of 1900). [Birds or game taken in this State shall not be transported without the State, nor taken or possessed with intent to transport the same without the State.]

SEC. 39. A person who violates any provision of this article is guilty of a misdemeanor, and is liable to a penalty of sixty dollars and to an additional penalty of twenty-five dollars for each bird, or part of bird taken or possessed in violation thereof.

Approved May 2, 1900.

SEC. 1109, Penal Code. [Shooting or hunting upon the first day of the week is prohibited.]

NORTH CAROLINA.

Code of North Carolina, 1888, Vol. II, p. 235.

SEC. 2834. No person shall kill or shoot, trap or net any partridges, quail, doves, robins, lark, mocking-birds or wild turkeys, between the first day of April and the fifteenth day of October in each year; and the person so offending shall be guilty of a misdemeanor, and fined not exceeding ten dollars for each offence. (1874–75, chap. 195; 1881, chap. 254.)

SEC. 2837. [No person shall hunt or shoot wild fowl on Sunday.]

NORTH DAKOTA.

Laws of 1899, chap. 93, p. 125.

SEC. 2. [It shall be unlawful for any person to hunt, kill, or wound any of the birds hereinafter mentioned without having first obtained a permit, under penalty of a fine of $20 to $50 or imprisonment not exceeding 30 days: *Provided*, That nothing in this section shall prevent any resident of this State, or member of his family living at home, from hunting on lands owned or controlled by him during the open season as provided by law, or shall prevent children under the age of 16 years from hunting if they have the written consent of their parents or guardians.]

SEC. 4. [The county auditor shall issue permits to any person applying therefor, on payment of $25, if the applicant is a nonresident of the State, and on payment of 75 cents if a resident of this State. All permits shall expire on the thirty-first day of December next after their issuance. It shall be unlawful for the State game warden or any of his deputies, or any county auditor, to issue complimentary or special permits.]

SEC. 7. Every person who either:

1 Shoots or kills * * * any song bird or insect-eating bird, except snipe or plover, at any time; or

4 Shoots or kills any * * * crane * * * between the first day of May and the twentieth day of August following; or

6 Uses or employes any trap, snare, net or bird lime, or medicated, drugged or poisoned grain or food to capture or kill any of the birds mentioned in subdivisions 1, 2, 3, or 4 of this section; or

7 Wantonly destroys any nest or eggs of any of the birds mentioned * * *

Is guilty of a misdemeanor, and upon conviction thereof before any justice of the peace of the county, is punishable by a fine of not exceeding ten dollars for each of the birds mentioned in subdivisions 1, 2, 3 or 4 of this section, so shot or killed or nest or eggs so destroyed, and for each violation of subdivisions 5 or 6 of this section. * * *

Approved March 8, 1899.

OHIO.

Revised Statutes, 1897 (as amended by General Acts of 1898, Vol. XCIII, p. 106).

SEC. 6960. No person shall at any time, kill or injure, or pursue with such intent, any sparrow, nuthatch, warbler, flicker, viroe [vireo], wren, robin, catbird, tanager, bobolink, blue-jay, oriole, grosbeak or red bird, creeper, redstart, waxwing, woodpecker, humming bird, bunting, starling, redwing, purple martin, brown thrasher, American goldfinch, chewink or ground robin, pewee or phoebe bird, chickadee, fly catcher, gnat catcher, mouse hawk, whippoorwill, snowbird, titmouse or eagle. No person shall, at any time, destroy the eggs or nest of any of the birds named in this section. Any person violating any of the provisions of this act shall be guilty of a misdemeanor, and on conviction thereof, shall be fined as provided in section 6968; provided further, that nothing in this act shall prohibit the killing of the house or English sparrow at any time, by anybody, or prohibit the killing of the American robin and blue-jay, by the owner or tenant of any premises where such birds are found destroying berries or fruit growing on such premises.

SEC. 6960*a*. The provisions in section 6960 of this act shall not apply to any person holding a permit giving the right to take birds or their nests and eggs for scientific purposes as herein provided. [Permits may be granted by the president of the fish and game commission to any properly accredited person. Applicants must present to said president of the fish and game commission written testimonials as to good character and fitness from two well-known scientific men or teachers of science, must pay one dollar, and must file a properly executed bond in the sum of one hundred dollars signed by at least two responsible citizens of the State as sureties. Permits shall be in force two years from date of issue and shall not be transferable.]

SEC. 6961. [No person shall kill any dove except between July 4 and December 15, or destroy the eggs or nests of any of the birds named in this section. No person shall hunt, shoot, or trap, or have in possession in the open air, the implements for hunting, shooting, or trapping, on the first day of the week, called Sunday.]

Passed April 12, 1898.

SEC. 6965. [Prohibits killing, maiming, or discharging firearms at any wild pigeon while it is on its nesting ground or at its roosting place, or breaking up or disturbing any pigeon roost or nesting place or the birds therein, or discharging any firearm within one-half mile of any pigeon roost or nesting place, or disturbing or destroying any pigeon eggs or nestlings, under penalty provided in section 6968.]

SEC. 6968. [Any person convicted of any violation of any of the provisions of this act shall be fined not less than twenty-five (25) dollars, nor more than one hundred (100) dollars, and in case of neglect or refusal to pay said fine, be imprisoned in the county jail or workhouse, and shall there remain for the full period of thirty days. (Revised Statutes, 1897.)]

OKLAHOMA.

Session Laws of 1899, Chap. XV, p. 164.

SEC. 1. It shall be unlawful for any person to wound, kill, ensnare, or trap in any manner within this Territory, any * * * wren, martin, swallow, robin, turkey buzzard, plover, dove or insectiverous [sic] birds, or pursue the same with such intent or to have the same in their possession, except * * * it shall be lawful to shoot plover and dove between the first day of August and the thirty-first day of December of each year * * * and any person who shall violate any of the provisions of this section, shall be deemed guilty of a misdemeanor, and shall be, on conviction, fined not less than twenty-five dollars nor more than one hundred dollars, with costs of suit, and in default of payment shall be committed until same is paid.

Approved March 10, 1899.

OREGON.

General Laws of 1895, p. 59. Act to protect the native song birds.

SEC. 1. Every person who shall, within the State of Oregon, after the passage of this act, for any purpose, injure, take, kill or destroy, or have in his possession, sell or offer for sale any yellow-breasted chat, meadow lark, robin, song sparrow, lark-finch, variegated thrush, wood thrush, hermit-thrush, American goldfinch, bluebird, snowbird, oriole, lazuli-finch, house and winter wren, pine linnet, California linnet, warblers, vireo, swallow, tanager, grossbeaks, kinglets or horned lark, shall be guilty of misdemeanor.

SEC. 2. Every person who shall, within the State of Oregon, at any time after the passage of this act, destroy or remove from nests of any yellow-breasted chat, meadow lark, robin, song sparrow, lark-finch, variegated thrush, wood thrush, hermit-thrush, American goldfinch, bluebird, snowbird, oriole, lazuli-finch, house and winter wren, pine linnet, California linnet, warblers, vireo, swallow, tanager, grossbeak, kinglets or horned larks, any egg or eggs of such birds or have in possession, sell, or offer for sale any such eggs, or willfully destroy the nests of any such birds shall be guilty of a misdemeanor.

Sec. 3. Every person convicted of a violation of any of the provisions of this act shall be punished by a fine of not less than five dollars, and not more than one hundred dollars, and in default of the payment of the fine imposed, shall be imprisoned in the county jail of the county where the offense was committed, at the rate of one day for each dollar of the fine imposed.

Approved February 23, 1895.

General Laws of 1895, p. 97. Act for the protection of game, fish and wild fowl.

Sec. 25. Every person who shall within the State of Oregon after the passage of this act for any purpose injure, take, kill or destroy or have in his possession, except for breeding purposes, sell or offer for sale any nightingale, skylark, black thrush, gray singing thrush, linnet, goldfinch, greenfinch, chaffinch, bullfinch, red-breasted European robin, black starling, grossbeak, Oregon robin or meadow lark or mocking bird, shall be guilty of a misdemeanor.

Sec. 26. Every person who shall within the State of Oregon at any time after the passage of this act, destroy or remove from the nest of any nightingale, skylark, black thrush, gray singing thrush, linnet, goldfinch, greenfinch, chaffinch, bullfinch, red-breasted European robin, black starling, grossbeak or mocking bird, any egg or eggs of such bird, or have in possession, sell or offer for sale any such egg or eggs, or willfully destroy the nests of any such birds, shall be guilty of a misdemeanor.

Sec. 27. That every person who shall, within the State of Oregon, after the passage of this act, willfully take, injure or destroy, any sea gull shall be guilty of a misdemeanor.

Sec. 31. Every person convicted of a violation of sections * * * [25, 26, and 27] of this act shall be punished by a fine of not less than twenty-five dollars and not more than two hundred dollars, or imprisonment in the county jail of the county where the offense was committed for not less than three months, or both such fine and imprisonment.

Approved February 25, 1895.

PENNSYLVANIA.

Laws of 1897, No. 103, p. 124.

Sec. 1. [That there shall be no hunting or shooting on the first day of the week called Sunday, under penalty of $25 for each offense, or imprisonment for a period of one day for each dollar of penalty imposed.]

Sec. 2. That no person in this Commonwealth shall kill, wound, trap, net, snare, catch with birdlime or any similar substance, poison or drug, any bird of song or any warbler, linnet, titmouse, blue bird, sparrow, yellow bird, thrush, downy woodpecker, hairy woodpecker, pileated woodpecker, red bellied woodpecker, red headed woodpecker, catbird, pewee, vireo, martin, tanager, tiltup, blue finch, indigo bird, oriole, shrike, kildeer, gnatcatcher, snow bird, hair bird, grossbeak, whip-poor-will, cuckoo, chewink, chickadee, chat, phœbe bird, redstart, finch, humming bird, cow bird, shore lark, wren, swallow, robin, grackle, meadow lark, nuthatch, least bittern, swift, nighthawk, starling or bunting. Nor shall any person purchase or have in possession, or expose for sale, any of the aforesaid song or wild birds, or the game mammals killed or taken in this State except as hereinafter provided; but nothing herein shall be construed to prevent the keeping of song birds in cages as domestic pets. No person shall take or needlessly destroy the nest or eggs of any song or other wild birds except as hereinafter provided. This act shall not apply to any person holding a certificate giving the right to take birds and their nests and eggs and game mammals for scientific purposes in accordance with the following provisions. [Certificates may be granted by board of game commissioners to any properly accredited person of fifteen years of age or upward. The applicant must present to the board written testimonials as to his good character and fitness from two well known scientific men, must pay five dollars, and must file a properly executed bond in the sum of one hundred dollars signed by two responsible citizens of the Commonwealth as sureties. Certificates shall be in force one year from date of issue and shall not be transferable.] The English or European house sparrow, the kingfisher, cooper's hawk, sharp-shinned hawk, duck hawk, pigeon hawk, great horned owl, and barred owl, green heron and night heron are not to be included among the birds protected by this act. Any person or persons violating any of the provisions of this act shall be liable to a penalty of ten dollars for each and every violation, or in default of payment thereof by imprisonment in the county jail for a period of one day for each dollar of penalty imposed.

Sec. 6. [No person shall catch, take, kill or have in his possession any of the birds, the killing of which is prohibited, with intent to ship or remove the same beyond the limits of this State or with intent to allow or aid in the shipment or removal thereof out of this State.]

Sec. 10. Except as provided for in section two, no person, for any reason or purpose whatever, shall take, have in his or her possession or under control, break or destroy or in any manner interfere with any nest or the eggs therein *or* [of?] any of the kinds of birds the killing of which is at any time or all time herein prohibited: *Provided*, That this does not apply to persons who have obtained certificates permitting them to collect the nests and eggs of wild birds other than game birds. Whoever shall offend against any of the provisions of this section shall be liable to a penalty of fifty dollars for each and every offense so committed, or by imprisonment in the county jail for a period of one day for each dollar of penalty imposed.

Approved June 4, 1897.

Sec. 11. (Act of June, 1878.) [No person shall kill any reedbird except in the months of September, October and November.]

Sec. 1. (Act of May 17, 1883.) [It shall be lawful to kill web-footed wild fowl only from September 1 to May 1 in each year.]

RHODE ISLAND.

General Laws, 1896, chap. 112, p. 380 (as amended by Public Laws of 1900, chap. 746.)

Sec. 1. Every person who shall take, kill, destroy, buy, sell, or offer for sale, or have in his possession any wild bird, or birds, at any season of the year, except as hereinafter provided, shall be fined twenty dollars for each of such birds.

Sec. 2. Every person who shall pursue with intent to kill any wild bird, except as hereinafter provided, shall be fined twenty dollars for each offence.

Sec. 3. Every person who shall wilfully disturb or destroy the nest or eggs of any wild bird, except as hereinafter provided, shall be fined twenty dollars for each offence.

Sec. 5. Sections 1, 2, and 3 of chapter 112 shall not apply to the killing of English sparrows, hawks (except fishhawks), owls, crows, and crow-blackbirds at any season of the year, by any person on his own land.

Sec. 11. Every person who shall between the sixteenth day of December and the 15th day of October next following, inclusive, shoot at or kill any bird upon land not owned or occupied by himself, and without permission of the owner or occupant thereof, shall forfeit and pay to the owner or occupant thereof five dollars for the first offence and ten dollars for every subsequent offence in addition to the damages sustained.

Sec. 12. Any person above the age of fifteen years, having a certificate from the curator of the museum of zoology of Brown University, the President of the Rhode Island College of Agriculture and Mechanic Arts, or from any incorporated society of natural history or college in the State, to the effect that said person is engaged in the scientific study of ornithology, or is making collections in the interest of, or for said institutions, or any one of them, may take the nest and eggs of, or at any season of the year may take or kill, any undomesticated birds, except those named in section four [woodcock, ruffed grouse, quail, black duck, wood-duck, teal, coot, scoter, or any other duck, geese, brant, peep, plover, snipe, sandpiper, sanderling, greater and lesser yellowlegs, curlew, and rail].

Passed May 4, 1900.

Sec. 16 (as amended by chap. 678, Public Laws of 1899, p. 119). [Provides that the governor shall appoint five commissioners of birds one from each county, who shall hold office for three years and shall protect birds throughout the state and prosecute every person violating laws relating to birds. Said commissioners may appoint deputies not exceeding five in each county and any commissioner or deputy may arrest, without warrant, every person whom they shall find pursuing with intent to kill, taking or killing birds, or who shall have birds in his possession contrary to the laws of the state relating to birds; and may seize without warrant, any birds found in the possession of any person when killing of such birds is prohibited.]

Passed May 25, 1899.

SOUTH CAROLINA.

Revised Statutes, 1893, vol. 2, p. 405.

Sec. 426. It shall not be lawful for any person in this State to wantonly shoot, or entrap for the purpose of killing, or in any other manner destroy, any bird whose principal food is insects, or take or destroy the eggs or young of any of the species or varieties of birds that are protected by the provisions of this Section, comprising all the species and varieties of birds represented by the several families of bats, whippoorwills, fly-catchers, thrashers, warblers, finches, larks, orioles, nut-hatchers [sic], woodpeckers, humming birds, blue-birds, and all other species and varieties of land birds, whether great or small, of every description, regarded as harmless in their habits, and whose flesh is unfit for food, including the turkey buzzard, but excluding the jackdaw, the crow, the crow black-bird, the eagle, and all hawks and owls which prey upon other birds; and any person violating the provisions of this Section shall on conviction thereof forfeit and pay a fine of ten dollars or be imprisoned not less than ten days, * * * *Provided*, that no person shall be prevented from protecting any crop of fruit or grain on his own lands from the depredations of any birds herein intended to be protected. (1872, XIV, 160.)

Sec. 427. No person or persons shall at any time or place within this State take, kill, sell, expose for sale, export beyond the limits of the State, or cause to be taken, killed, sold, exposed for sale or exported beyond the limits of the State, any mocking bird, nonpareil, swallow, bee bird, red-bird, woodpecker, thrush or wren under a penalty of five dollars for each bird so taken, killed, sold, exposed for sale or exported beyond the limits of the State; and it shall be lawful for any person to take or destroy any net, traps or snares used for taking such birds wheresoever found set for such purpose: *Provided*, That nothing herein contained shall prohibit any person from taking and keeping any bird of song or plumage for his own pleasure or amusement, and not for sale, traffic or gain. (1878, XVI, 406; 1883, XVIII, 324.)

Sec. 428. No person or persons shall destroy or rob the nests of any of the said birds under a penalty of ten dollars for each offense.

SEC. 432. It shall not be lawful for any person in this State to catch, kill, injure, sell or expose for sale * * * any dove between the first day of March and the first day of August. And any person so doing shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not more than twenty dollars or be imprisoned not more than thirty days.

SEC. 433. Nothing herein shall apply to any person who shall kill or take any of the said birds for the purpose of studying its habits or history, or having the same stuffed and set up as a specimen, or to any person who shall kill on his premises any of the said birds in the act of destroying fruit or grain crops.

SOUTH DAKOTA.

Session Laws of 1899, chap. 90, p. 111.

SEC. 1. (1) Every person who shoots or kills * * * any song bird or insect eating bird at any time, excepting crows, blackbirds and sparrows; or (2) * * * kills any * * * wild crane between the first day of May and the first day of September following; * * * or (4) uses or employs any trap, snare, net or bird lime, or medicated, drugged or poisoned grain or food to capture or kill any of the birds mentioned * * * or (5) wantonly destroys any nest of [or] eggs or [of] any of the birds mentioned * * * (8) is guilty of a misdemeanor, and upon conviction thereof before a justice of the peace of the county, is punishable by a fine of not more than ten dollars ($10) for each of the birds mentioned * * * so shot or killed or nests or eggs so destroyed.

SEC. 4. Any attempt to violate any provision of any section of this Act shall be deemed a violation of such provision.

Approved March 6, 1899.

TENNESSEE.[1]

Annotated Code, 1896.

[ARTICLE XI, section 13 of the constitution provides that "The general assembly shall have power to enact laws for the protection and preservation of game and fish within the State, and such laws may be enacted for and applied and enforced in particular counties or geographical districts, designated by the general assembly."]

SEC. 2898. [It shall be unlawful for any person to kill "any song bird, or bird that feeds on insects that destroy fruit trees," in the county of Hardin between March 15 and September 15, or to destroy the nests or young of such birds. (1889, chap. 95, sec. 2.)]

SEC. 2899. [Penalty for violation of section 2898, a fine of not less than $5.]

SECS. 2905, 2907. [Prohibit killing of larks in Warren County between March 1 and October 1, under penalty of fine of $10 to $25 for each lark killed. (1895, chap. 162.)]

SEC. 2936. No person shall hunt, capture, or kill any song bird, as the mocking bird, thrush, robin, and oriole; or any game bird as the * * * lark; or any bird that feeds on insects which destroy fruit trees, as the sparrow, catbird, bluebird, and woodpecker, in Robertson, Davidson, Maury, and Shelby counties, from the first day of February to the first day of September; nor in Lincoln county from the first day of March to the fifteenth day of September. (1873, chap. 83; 1877, chap. 162; 1870, chap. 99.)

SEC. 2937. No person shall at any time destroy the nests or eggs of any of said birds in any of the counties named in last section. (Ibid.)

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[1] These laws are compiled from the Annotated Code. There may be other County laws passed since 1896 which have been overlooked.

Sec. 2938. [Penalty for violation of sections 2936 and 2937, fine of $5 for every bird killed, and also for every nest robbed or destroyed.]

Secs. 2940–2941. [Prohibit killing of larks, from March 1 to September 15, or killing of mocking birds, thrushes, robins or orioles, "or any birds known to destroy insects, as the sparrow, bluebird, woodpecker, or yellowhammer;" or to destroy their nests or eggs in Henry, Dyer, Giles, Maury, Davidson, Madison, Hamilton, Bedford, and Wilson counties under penalty of fine of $2.50 for every bird killed or nest robbed or destroyed. (1875, chap. 127; 1887, chap. 130.)

Doves, larks and robins may be killed in Wilson county between August 1 and April 1. (Acts 1899, chap. 57, sec. 4, p. 80.)]

Secs. 2943–2946. [Prohibit killing in Montgomery and Cheatham counties "any song bird as the mocking bird, thrush, robin, or oriole; or any bird that feeds on insects, as the sparrow, catbird, bluebird or woodpecker" or lark from March 1 to October 15, or killing of doves from March 1 to August 1, or destroying the nests and eggs or holding any lark or dove in captivity during close season, except oath is made at time of acquiring possession that they are retained in captivity for purpose of being set free in county aforesaid, under penalty of punishment for misdemeanor. (1879, chap. 22.).]

Sec. 2957. [Prohibits killing, in Greene and Bradley counties, of larks and doves between February 1 and November 1, or killing or capture of "any of the birds of song as the thrush, the robin, the redbird, the oriole, the mocking bird," or "any of the birds known to destroy insects, as the American sparrow, bluebird, woodpecker, yellowhammer," under penalty of fine of not less than $5 or imprisonment not less than five days. (1893, chap. 152.).]

TEXAS.

Revised Statutes, 1895, Penal Code, Title XIII, chap. 5, p. 100.

Art. 518. If any person shall willfully kill or in any manner injure any mocking bird, whippoorwill, night hawk, blue bird, red bird, finch, thrush, linnet, wren, martin, swallow, bobolink, cat bird, nonpareil, scissortail, sparrow, buzzard or carrion crow, he shall be deemed guilty of a misdemeanor, and upon conviction before a justice of the peace or other court of competent jurisdiction, he shall be fined a sum of not less than five nor more than fifteen dollars. (Act March 15, 1881, p. 30.)

Art. 519. If any person shall willfully kill any seagull, tern, shear-water, egret, heron, or pelican, or shall willfully take from their nests or in any manner destroy any egg or eggs of any seagull, tern, shear-water, egret, heron or pelican, he shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than five nor more than twenty-five dollars; provided, that the killing of any of the birds above enumerated, or taking of their eggs with intent to preserve the same for scientific purposes, shall not be construed to be a violation of this act. (Act April 13, 1891, chap. 71, p. 90.)

Art 520 (as amended by Acts of 1895, p. 158). [The following counties are hereby exempted from the provisions of article 518: Cherokee, Shelby, Franklin, Rockwall, Hopkins, Williamson, Coryell, Mills, Commanche, Runnels, Cooke, Wise, Madison, Clay, Jack, Stephens, Polk, Throckmorton, Callahan, Taylor, Jones, Kent, Garza, Lynn, Terry, Yoakum, Trinity, Archer, Lamar, Cass, San Jacinto, Camp, Dimmit, Jackson, Kaufman, Angelina, Sabine, Walker, Trinity, Panola, Jack, Young, Lee, Bastrop, Brazos, Wilson, Freestone, Lampasas, Brazoria, Nacogdoches, Hill, Rusk, Burnet, Karnes, Atascosa, Wood, Rains, and San Augustine. (See p. 46.)]

UTAH.

Laws of 1899, chap. 26, p. 42.

SEC. 21. [Permits killing of mourning doves between July 1 and December 1, but prohibits the robbing or destroying of nests, eggs or young.]

SEC. 22. It shall be unlawful for any person to kill, ensnare, net or entrap at any time in any year any gull, owl, hawks, lark, whippoorwill, thrush, swallow, snowbird, robins or other insectivorous or song birds, except the English sparrow, or to rob or destroy the nests, eggs or young of any of said protected birds mentioned in this section.

SEC. 27. Any person violating any of the provisions of this act * * * shall be guilty of a misdemeanor and shall be fined not less than ten dollars.

SEC. 29. [It shall be unlawful for any person at any time to ship or cause to be shipped out of the State, any of the birds or any part thereof mentioned in this act.]

Approved March 9, 1899.

VERMONT.

Vermont Statutes, 1894, title 31, chap. 189, p. 829.

SEC. 4614. If a person shoots, or otherwise intentionally wounds, entraps, ensnares or captures a wild or undomesticated bird, except quail, woodcock, wild duck, Wilson's or English snipe, ruffed grouse, wild goose, plover, pheasant, English partridge, merganser, blue heron, bittern, loon, English sparrow, crow black bird, crow, jay, or birds of prey, or if a person destroys the nest or eggs of any wild or undomesticated birds, except the nest or eggs of a merganser, blue heron, bittern, loon, English sparrow, crow black bird, crow, jay and birds of prey, he shall be fined five dollars for each offense.

SEC. 4613 (as amended November 4, 1898, Act 104, p. 81). [Provides for permits to collect for scientific purposes as follows: "The fish and game commissioners may commission persons, for a time specified, reserving a power of revocation, to take, kill, capture and have in possession any species of birds other than domestic, and the nests and eggs thereof, for scientific purposes only, but the number of such commissions in force at any one time shall not exceed five."]

VIRGINIA.[1]

Code, 1887, title 27, chap. 95, p. 520.

SEC. 2079. It shall be unlawful for any person * * *

Third * * * at any time, to kill the turkey buzzard or black buzzard, or to capture, for sale or transportation, or kill the mocking bird, or kill or capture the brown thrush, cardinal or red bird, wood robin, blue bird, house martin, or starling, or destroy their nests or

Fifth * * * to shoot, or in any manner kill or destroy the bird known as the gull or striker, before the first day of September, or take its eggs later in the season than the twentieth of July.

SEC. 2080. If any person violate any of the provisions of the preceding section, he shall be deemed guilty of a misdemeanor, * * * the offender shall be fined ten dollars for each offence and imprisoned in jail until the fine be paid, but not exceeding thirty days.

SEC. 2081. The two preceding sections shall not apply to the counties of Mecklenburg, Brunswick, Dinwiddie, Sussex, Greenesville, Cumberland, Nottoway, Lunenburg, Amelia and Appomattox. * * *

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[1] No attempt has been made to include the special county laws.

WASHINGTON.

Session Laws of 1897, Chap. LII, p. 86.

SEC. 9. [Prohibits trapping of wild pigeons under penalty provided in section 18.]

SEC. 16. Every person who shall, at any time, take, kill, injure or destroy, trap, ensnare, molest or disturb, or have in his possession, sell, or offer for sale, any nightingale, skylark, black thrush, gray singing thrush, goldfinch, greenfinch, bullfinch, red breasted robin, English robin, black starling, grosbeak, meadow lark, mocking bird, wild canary bird, or other song bird, shall be guilty of a misdemeanor, and upon conviction thereof shall be punished as hereinafter provided.

SEC. 17. Every person who shall at any time, take from the nest of any song bird, the egg or eggs of such birds, or disturb, molest or destroy the nest of the song birds of this state shall be guilty of a misdemeanor, and upon conviction thereof shall be punished as hereinafter provided.

SEC. 18. Every person convicted of any of the misdemeanors defined in the foregoing sections of this act, shall be punished by a fine of not less than ten dollars ($10) nor more than one hundred ($100) dollars, together with the costs of the prosecution in such action, and in default of the payment of said fine, shall be imprisoned in the county jail one day for each two dollars ($2) of such fine.

Approved March 11, 1897.

Session Laws of 1899, Chap. V, p. 7.

SEC. 1. [Every person who shall kill any sandhill crane between March 1 and August 15 of any year shall be guilty of a misdemeanor.]

WEST VIRGINIA.

Code, 1891, Chap. LXII, p. 604.

SEC. 10 (as amended by Acts of 1897, chap. 30, p. 85). It shall be unlawful for any person at any time to catch, kill or injure, or pursue with intent to catch, kill or injure, or to have in his possession, either dead or alive, any of the birds, or their kindred or allied species, in this section hereinafter mentioned; and it shall, also, be unlawful for any person to disturb or destroy the eggs or nest of any of the birds or their kindred or allied species, in this section hereinafter named; that is to say: turkey buzzard, the family of pingilladæ [sic] or sparrows, except English sparrows, robin, bluebird, martin, thrush, mocking-bird, swallow, oriole, cat-bird, chewink, wren, cuckoo, indigo-bird, nuthatch, yellow-hammer or flicker, warbler or finch, redstart, dummock, nightingale, crossbill, Hungarian robin, titmouse, tit or tomtit, woodpecker or purple grackle, red-wing, blackbird, blue-jay, phœbe-bird or pewee, redbird or cardinal grosbeck, humming-bird, dove, whip-poor-will and any other bird whose habits are not essentially predatory upon and destructive of the agricultural products of man.

Approved February 24, 1897; in effect May 23, 1897.

SEC. 12. And it shall be unlawful for any person to destroy or disturb the eggs cf any of the birds protected by this chapter; and any person offending against any of the foregoing provisions of this chapter, shall be fined in any sum not less than two dollars, nor more than twenty-five dollars, for each offence on conviction in the proper court, or be imprisoned in the county jail not more than twenty days, or both at the discretion of the court, and pay the costs of prosecution. (Acts 1875, chap. 117; 1882, chap. 89.)

WISCONSIN.

Wisconsin Statutes, 1898, chap. 62, vol. 1, p. 1112.

SEC. 1498*i*. The [fish and game] warden may grant, on satisfactory testimonials of well-known scientists only, a certificate to any member of an incorporated society of natural history or to any professor of any university, school or college, or any person properly accredited by any such institution, authorizing such person or institution to collect, for scientific purposes only, the nests, eggs, animals, birds and fish protected by these statutes. No person to whom such certificate is issued or who acts under the same shall dispose of any such specimens except in exchange for scientific purposes.

Wisconsin Statutes, 1898, chap. 185, vol. 2, p. 2759.

SEC. 4563 (as amended by Acts of 1899, chap. 267, sec. 1). [Any person who shall take, catch or kill any wild duck, brant, or any aquatic fowl, excepting wild geese, between January 1 and September 1, shall be punished by a fine of $20 to $50, or by imprisonment of 10 to 60 days, or by both such fine and imprisonment.]

SEC. 4565 (as amended by Acts of 1899, chap. 311, sec. 10, p. 558). Any person who shall catch or kill at any time, or for any purpose whatever, except as authorized by law, any whippoorwill, night-hawk, bluebird, finch, thrush, robin, lark, turtle dove, or any other harmless bird shall be punished by a fine of not more than fifty dollars or by imprisonment in the county jail for not more than thirty days, provided that this section shall not apply to blackbirds, crows, English sparrows or pigeons for trapshooting.

SEC. 4565*a*. Any person who shall take or destroy the eggs or nest of any water-fowl or bird, except crows and English sparrows, shall be punished by a fine of not more than five dollars or by imprisonment in the county jail for not more than ten days.

SEC. 4566*a*. An attempt to violate any of the provisions of the * * * preceding sections shall be deemed a violation thereof.

[NOTE.—The index refers to 'Birds not killed for millinery purposes, § 4567a, p. 2761.' No such section has been found, the one indicated referring to fish.]

WYOMING.

Session Laws of 1899, chap. 19, p. 31.

SEC. 12. No person shall kill, net or trap within this State, except as hereinafter provided, any * * * Lark, Whippoorwill, Finch, Thrush, Snow-bird, Turkey Buzzard, Robin or other insectivorous birds. * * *

Any person who shall violate any of the provisions of this Section shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in any sum not less than ten, nor more than fifty dollars, together with costs of suit, and shall be prosecuted and punished in the same manner as in other cases of misdemeanor.

SEC. 13. [Killing of wild swans prohibited at any time under a penalty of $10 to $25 and imprisonment not exceeding 60 days.]

Approved February 15, 1899.

III. CANADIAN LAWS FOR THE PROTECTION OF BIRDS.

Measures for the protection of birds in the Provinces of Canada are similar in many respects to those in force in the United States. British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, and Quebec all have statutes relating to non-game birds, but apparently no such laws are in force in Prince Edward Island or the Northwest Territories. The recent laws of Manitoba have not been seen, and it is possible that some amendment to the Revised Statutes which should be included has been overlooked.

BRITISH COLUMBIA.

Statutes of 1898, chap. 24, p. 123.

[Sec.] 2. * * * The expression, "game bird," wherever the same occurs in this Act, shall mean a bird protected by the provisions of this Act.

[Sec.] 5. No person other than the importer, on his own property held as a private reserve, shall hunt, trap, take, shoot at, kill or wound any game birds or animals hereafter imported for acclimatization purposes and distributed in any part of the Province, until such time, and thereafter under such regulations, as the Lieutenant-Governor shall appoint and make under the provisions of section 23 hereof.

[Sec.] 7. No eggs of any of the birds mentioned in this Act shall be taken, destroyed or had in possession by any person at any time: *Provided, however,* It shall be lawful for the Provincial Secretary, on such conditions as he shall think fit, by writing under his hand, to at any time authorise any person to trap or have in his possession any birds, or take eggs, for breeding or acclimatization purposes. * * *

[Sec.] 10. It shall be unlawful to catch, kill, destroy or pursue, or to buy, sell, or expose for sale, show or advertisement, any of the game birds or animals during the close seasons and prohibited times of sale set out in the following Schedule B, which is deemed to be part of this Act, or otherwise contravene the provisions thereof.

[Schedule B declares it unlawful at any time to shoot or destroy, buy, sell, or expose for sale, show, or advertisement, birds living on noxious insects, blackbirds (English), chaffinch, gull, linnet, robin, skylark, thrush, or eggs of protected birds. It is unlawful to shoot or destroy bittern or meadow lark between March 1 and August 31, or to buy, sell, or expose for sale at any time.]

[Sec.] 12. The provisions of this Act shall not apply to * * * the Curator of the Provincial Museum, or his assistant, assistants, or agent (appointed by him in writing), while collecting specimens of natural history for the Provincial Museum.

[Sec.] 23. It shall be lawful for the Lieutenant-Governor, in Council from time to time to make rules and regulations, not inconsistent with the provisions of this Act, for carrying out the true intent and meaning hereof, and for the protection of game in the Province, and to provide penalties for the infraction thereof, and such rules and regulations, after being published in two successive issues of the British Columbia Gazette, shall have the force and effect of law.

MANITOBA.

Revised Statutes, 1891, I, chap. 75, p. 803.

[SEC.] 1. This Act may be cited as "The Insectivorous Birds Act."

[SEC.] 2. Nothing in this Act contained shall be held to affect "The Game Protection Act," or to apply to any imported cage birds or other domesticated bird or birds generally known as cage birds, or to any bird or birds commonly known as poultry. (53 V., c. 33, s. 1.)

[SEC.] 3. It shall not be lawful to shoot, destroy, wound or injure, or to attempt to shoot, destroy, kill, wound or injure, any bird whatsoever, save and except eagles, falcons, hawks, owls, wild pigeons, black-birds, king-fishers, jays, crows, English sparrows, ravens, shrikes, bitterns, curlews, cranes, rusty grackle, purple grackle, cormorants, gulls, mergansers, pelicans, loons and the birds specially mentioned in "The Game Protection Act." (53 V., c. 33, s. 2.)

[SEC.] 4. It shall not be lawful to take, capture, buy, sell, expose for sale or have in possession any bird whatsoever, save the kinds hereinbefore or hereinafter excepted, or to set, wholly or in part, any net, spring, snare, cage or other machine or engine by which any bird whatsoever, save and except eagles, falcons, hawks, owls, wild pigeons, black-birds, king-fishers, jays, crows, English sparrows, ravens, shrikes, bitterns, curlews, cranes, rusty grackle, purple grackle, cormorants, gulls, mergansers, pelicans and loons, might be killed and captured; and any net, trap, spring, snare, cage or other machine or engine, set either wholly or in part for the purpose of capturing or killing any bird or birds, save and except eagles, falcons, hawks, owls, wild pigeons, black-birds, king-fishers, jays, crows, English sparrows, ravens, shrikes, bitterns, curlews, cranes, rusty grackle, purple grackle, cormorants, gulls, mergansers, pelicans and loons, may be destroyed by any person without such person incurring any liability therefor. (53 V., c. 33, s. 3.)

[SEC.] 5. It shall not be lawful to take, injure, destroy or have in possession any nest, young or egg of any bird whatsoever, except of eagles, falcons, hawks, owls, wild pigeons, black-birds, king-fishers, jays, crows, English sparrows, ravens, shrikes, bitterns, curlews, cranes, rusty grackle, purple grackle, cormorants, gulls, mergansers, pelicans and loons. (53 V., c. 33, s. 4.)

[SEC.] 7. The Minister of Agriculture and Immigration and all persons authorized by him to that effect may grant written permission to any person or persons who may be desirous of obtaining birds or eggs for *bona fide* scientific purposes to procure them for those purposes, and such person or persons receiving such permission shall not be liable to any penalty under this Act. (53 V., c. 33, s. 6.)

[SEC.] 8. The violation of any provision of this Act shall subject the offender to a fine of not less than one dollar and not more than twenty dollars, with costs, on summary conviction, on information or complaint before one or more justices of the peace or a police magistrate. (53 V., c 33, s. 7, s-s. 1.)

NEW BRUNSWICK

Acts of the General Assembly of 1899, Chap. VIII, p. 61.

[SEC.] 2. (*b*) The expression "game" includes any animal or bird mentioned in this Act, or of a species or class similar thereto.

[SEC.] 4. Everyone is guilty of an offence and liable to the penalty hereinafter provided who at any time or season hereafter, in any part of the Province:

(*a*) Hunts, takes, hurts, injures, traps, snares, shoots, wounds, kills or destroys: * * *

II. Any game on Sunday: [Penalty, double that for killing same game on any week day in close season.]

III. Any game in any park, pleasure resort, land or forest now or hereafter set apart or reserved for public park purposes: [Penalty, double that for killing same game in any other closed district.]

IV. Any sea gull, pheasant or any small birds which frequent the fields and woods (except such birds as to which special provisions are made in this Act, and excepting also blackbirds, crows and English sparrows), or removes, damages or destroys the nest or eggs thereof. [Penalty, $5 fine or 5 days' imprisonment.]

[Sec.] 7. Notwithstanding anything in this Act contained it shall be lawful to

(*a*) Hunt, take, shoot or kill * * *

II. Any game for preservation as specimens of natural history, or for scientific investigation, provided a license therefor is first obtained as provided in section 44.

[Sec.] 44. * * * The Surveyor-General may also issue licenses permitting the taking or killing of any game within the Province for preservation as specimens of natural history, or for scientific investigation.

[Sec.] 45. No license or permit issued under the provisions of this Act shall be valid unless signed by the Surveyor-General and countersigned by the chief game commissioner or warden who may have issued the same.

NEWFOUNDLAND.

Consolidated Statutes, second series, 1892, chap. 144, p. 980.

[Sec.] 2. No person shall hunt, wound, kill, take, sell, purchase, or give away, or have in his possession, any curlew, plover, snipe, or other wild or migratory birds (excepting wild geese), or the eggs of any such birds, within this colony between the twelfth day of January and the twentieth day of August in each year, under a penalty of not less than twenty-five dollars nor exceeding two hundred dollars, or, in default of payment, of imprisonment for a period not exceeding three months.

[Sec. 10 (Act of 1899). Any person, except a traveler on a journey, found on Sunday carrying firearms, shall be subject to a fine not exceeding $40, and in default of payment to imprisonment not exceeding one month.]

NOVA SCOTIA.

Statutes of 1896, chap. 4.

[Sec.] 22. The killing of robins, swallows, sparrows and other small birds and birds of song, which frequent the fields and gardens, and the selling and offering for sale, and the having in possession such birds when killed, is prohibited and unlawful.

[Sec.] 23. Any game mentioned in this Act may be killed or taken at any time for purposes of scientific investigation, and the eggs of game birds procured for propagation, a special license, setting forth the particular purpose of the inquiry, and signed by the Provincial Secretary or his deputy, having been first obtained for that purpose from the Provincial Secretary's office.

[Sec.] 24. The trapping, snaring or otherwise taking alive, or exposing for sale alive, of any of the birds mentioned in the twenty-second section, and the destroying of the nests or eggs of such birds, shall hereafter be unlawful, and any such trap or snares when found may be destroyed, and any such bird if alive shall be set free.

[Sec.] 25. Any person offending against the twenty-second or twenty-fourth section, shall for each offence incur a penalty of one dollar.

ONTARIO.

Revised Statutes, 1897, chap. 289.[1]

[SEC.] 1. Nothing in this Act contained shall be held to affect The Ontario Game Protection Act, or to apply to any imported cage birds or other domesticated bird or birds generally known as cage birds, or to any bird or birds generally known as poultry. (52 V., c. 50, s. 1.)

[SEC.] 2. (1) Except as in section 6 of this Act provided, it shall not be lawful to shoot, destroy, wound, catch, net, snare, poison, drug or otherwise kill or injure, or to attempt to shoot, destroy, wound, catch, net, snare, poison, drug or otherwise kill or injure any wild native birds other than hawks, crows, blackbirds and English sparrows, and the birds specifically mentioned in The Ontario Game Protection Act.

(2) Any person may, during the fruit season, for the purpose of protecting his fruit from the attacks of such birds, shoot or destroy, on his own premises, the bird known as the robin without being liable to any penalty under this Act. (52 V., c. 50, s. 2.)

[SEC.] 3. Except as in section 6 of this Act provided, it shall not be lawful to take, capture, expose for sale or have in possession any bird whatsoever, save the kinds hereinbefore or hereinafter excepted, or to set, wholly or in part, any net, by which any bird whatsoever, save and except hawks, crows, blackbirds and English sparrows, might be killed and captured; and any net, trap, springe, snare, cage or other machine or engine, set either wholly or in part for the purpose of either capturing or killing any bird or birds, save and except hawks, crows, blackbirds and English sparrows, may be destroyed by any person without such person incurring any liability therefor. (52 V., c. 50, s. 3.)

[SEC.] 4. Save as in section 6 of this Act provided, it shall not be lawful to take, injure, destroy or have in possession any nest, young or eggs of any bird whatsoever, except of hawks, crows, blackbirds, and English sparrows. (52 V., c. 50, s. 4.)

[SEC. 6. The chief game warden may grant to ornithologists, students of ornithology, biologists, or students of biology, permits to collect, purchase or exchange birds or eggs.]

[SEC. 7. Such permits shall continue in force until the end of the calendar year in which issued, and may be renewed at the option of the chief game warden.]

[SEC. 8. Violation of any provision of this Act shall subject the offender to the payment of a fine of \$1–\$20 with costs, or in default of payment imprisonment of from 2 to 20 days.]

Ontario Game Protection Act, 1900.

[SEC. 4. No person shall kill ducks of any kind or any other waterfowl between December 15 and September 1 of the following year.]

[SEC. 6. No person shall, on the Lord's Day, hunt, take, kill, or destroy any game animal or bird, or use any gun for that purpose.]

QUEBEC.

Statutes of 1899, Chap. XXIV, p. 73.

[SEC.] 1395*h*. For the purposes of this act, which may be cited as the "Quebec Game Laws," the Province of Quebec is divided into two zones, known respectively as Zone No. 1 and Zone No. 2.

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[1] For the copy of this law I am indebted to Mr. H. S. Osler, of Montreal.

Zone No. 1 comprises the whole Province, less that part of the counties of Chicoutimi and Saguenay to the east and north of the river Saguenay.

Zone No. 2 comprises that part of the counties of Chicoutimi and Saguenay to the east and north of the river Saguenay.

[SEC.] 1401. It is forbidden at all times [under a penalty of $2 to $5, provided by sec. 1410] to shoot or kill, and, between the first day of March and the first day of September in each year, to take by means of nets, traps, springs, snares, cages or otherwise any of the birds known as perchers, such as swallows, kingbirds, warblers, flycatchers, woodpeckers, whip-poor-wills, finches, (song sparrows, red-birds, indigo birds, &c.,) cow-buntings, titmice, goldfinches, grives, (robins, wood-thrushes, &c.,) kinglets, bobolinks, grakles, grosbeaks, humming-birds, cuckoos, &c., or to take their nests or eggs, except eagles, falcons, hawks and other birds of the falconidæ, owls, wild-pigeons, kingfishers, crows, ravens, waxwings (*recollets*), shrikes, jays, magpies, sparrows and starlings; and whosoever finds any nets, traps, springs, snares, cages, &c., so placed or set, may take possession of or destroy the same. (R. S. Q., 1401.) [This section applies to both zones 1 and 2.]

[SEC.] 1417. The Commissioner may grant written licenses to any person, *bona fide*, desirous of obtaining birds' eggs or fur-bearing or other animals for scientific or breeding purposes during the close season.

Persons not domiciled in the Province of Quebec shall for such licenses, pay a fee which shall not be less than five dollars, nor more than twenty-five dollars, to be determined by the Commissioner according to the number and importance of the objects such licenses are applied for.

No person, who has obtained such a license, shall be liable to any penalty enacted by this section, provided that, at the expiration of his license, he files, in the Department of Lands, Forests and Fisheries, a solemn declaration setting forth the species and number of birds, eggs and fur-bearing or other animals so procured by him for scientific or breeding purposes. (R. S. Q., 1417; 59 V., c. 20, s. 9.)

[SEC.] 1420. The Lieutenant-Governor in Council may, in his discretion, prohibit the hunting or killing of any bird or fur-bearing animal, for a period not exceeding five years. (R. S. Q., 1420.)

Assented to, February 25, 1899.

IV. BIRD AND ARBOR DAY LAWS.

CONNECTICUT.

Public Acts of 1899, chap. 14, p. 992.

Section 1576 of the general statutes is hereby amended to read as follows: The governor shall annually, in the spring, designate, by official proclamation, an arbor and bird day, to be observed in the schools, and in any other way as shall be indicated in such official proclamation.

Approved March 17, 1899.

MINNESOTA.

General Laws of 1899, chap. 36, p. 34.

Sec. 1. The governor is hereby authorized to set apart each year by proclamation one day to be designated as Arbor and Bird Day, and to request its observance by all public schools, private schools, colleges and other institutions, by the planting of trees and the adornment of the school and public grounds and by suitable exercises, having for their object the advancement of the study of arboriculture and promotion of the spirit of protection to birds and trees and the cultivation of an appreciative sentiment concerning them.

Approved March 3, 1899.

WISCONSIN.

Laws of 1897, chap. 61, p. 87.

Sec. 1. * * * The governor is hereby authorized to set apart each year, by proclamation, one day, to be designated as Arbor and Bird Day, and to request its observance by all public schools, private schools, colleges and other institutions, by the planting of trees, adornment of school and public grounds, and by suitable exercises having for their object the advancement of the study of arboriculture, the promotion of a spirit of protection to birds and trees, and the cultivation of an appreciative sentiment concerning them.

Approved March 17, 1897.

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BULLETIN No. 13

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF BIOLOGICAL SURVEY

FOOD

OF THE

BOBOLINK, BLACKBIRDS, AND GRACKLES

BY

F. E. L. BEAL, B. S.

ASSISTANT BIOLOGIST

PREPARED UNDER THE DIRECTION OF

DR. C. HART MERRIAM

CHIEF OF BIOLOGICAL SURVEY

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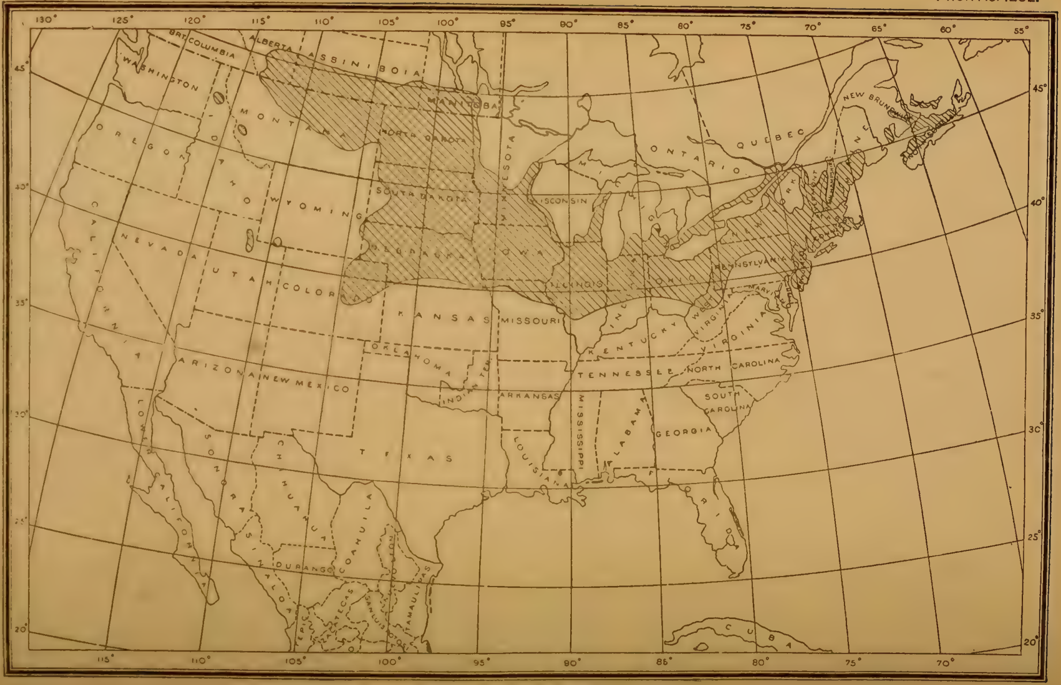

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MAP SHOWING BREEDING RANGE OF THE BOBOLINK (*Dolichonyx oryzivorus*).

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., May 22, 1900.

Sir: I have the honor to transmit herewith for publication as Bulletin No. 13 a report on 'The Food of the Bobolink, Blackbirds, and Grackles,' by Prof. F. E. L. Beal, assistant biologist. This report is based on a careful examination of the contents of more than 4,800 stomachs, representing nine species and several subspecies of American blackbirds. The family of orioles and blackbirds, to which the bobolink, cowbird, blackbirds, and grackles belong, is one of much economic importance. The ravages of the bobolink in the rice fields of the South, and of some of the blackbirds in the grainfields of the Upper Mississippi Valley at planting and harvesting time, are matters of common knowledge, but the other food of these and other species is not so well known. The present bulletin is devoted mainly to the food of the various blackbirds during the summer months; several of the species consume insects in such quantities at this time as to compensate in great measure for the grain they destroy.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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FOOD OF THE BOBOLINK, BLACKBIRDS, AND GRACKLES.

By F. E. L. Beal, B. S.,

Assistant Biologist, U. S. Department of Agriculture.

INTRODUCTION.

The birds commonly known as bobolinks, meadowlarks, orioles, blackbirds, grackles, and cowbirds are all comprised in a group known as the family Icteridæ, which is represented in the United States by 29 species and subspecies. These differ remarkably in plumage, nesting habits, and methods of obtaining food. The plain black in which many of them are clothed is relieved in the redwing by a touch of brilliant color, and in the bobolink (in spring dress) by white and buff; in the orioles it is usually reduced to a few patches to offset the bright tints; and in the meadowlarks is restricted to a black crescent on the breast. The orioles build their nests in trees, sometimes at a considerable height, and obtain their food among the leaves and branches. The bobolinks and meadowlarks build upon the ground and depend for food upon such insects and seeds as they find on the surface. The other species take an intermediate position, some, such as the crow blackbird, building in trees, and others on low bushes and rushes, but all obtaining the greater part of their food on the ground.

In this bulletin are discussed the food habits of the bobolink, the cowbird, the yellow-headed blackbird, the red-winged blackbird, the California red-winged blackbird, the rusty blackbird, Brewer's blackbird, the crow blackbird, and the boat-tailed grackle. These comprise all the important members of the group with the exception of the meadowlarks and orioles.[1] One or more of these species may be found at some time of the year in every State and Territory. As they are much given to nesting and feeding about farms and stock yards or to visiting outlying grainfields and pastures, the character of their food becomes a question of considerable importance to the cultivator.

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[1] A report on the food of the meadowlark and Baltimore oriole was published in the Yearbook of the Department of Agriculture for 1895, pp. 419–430; a preliminary report on the food habits of the crow blackbird appeared in the Yearbook for 1894, pp. 233–248; and the grain-eating habits of most of the blackbirds were discussed under the title 'Birds injurious to grain,' in the Yearbook for 1897, pp. 345–354.

Writers on ornithology give notes on the food of various species of birds, based for the most part on field observation, and in some cases on examination of stomachs, but usually such investigations are neither extensive nor systematic. In the early days, when birds were abundant and grainfields few, blackbirds, or 'maize thieves,' as they were called, were the first species to render themselves objects of notice by their attacks upon the crops of the early settlers, and bounties were offered for their destruction; in fact, they had already acquired a bad reputation with the aborigines by their depredations upon the patches of maize. Their very pronounced taste for grain, and their habit of associating in large flocks, soon attracted the attention of pioneer farmers everywhere; and it did not take these shrewd observers long to decide that the birds were a nuisance and to plan for their extermination. All devices of this kind, however, have (fortunately, perhaps) proved futile. The birds still flourish, though in somewhat reduced numbers, and are still a source of considerable damage in many places.

At the present day direct bounties are not so much in vogue as they were when the country was newer; and State laws protecting birds have become numerous. But the evil repute of the blackbirds has caused them to be omitted from many of these statutes, while in others either blackbirds in general or particular species are specially exempted from protection. Blackbirds in general are specially exempted in Maryland, Michigan, Wisconsin, Minnesota, and Arkansas; the crow blackbird in Vermont, Massachusetts, South Carolina, and Illinois; the ricebird (bobolink) in Georgia; the 'common blackbird' and the crow blackbird in New York; the crow blackbird in Rhode Island; and the crow blackbird and redwing in New Jersey.

In certain States near the Atlantic seaboard some species, notably the bobolink, are regarded as game, and an open season is provided for shooting them. In New Jersey 'reedbirds' (bobolinks) may be lawfully killed from August 25 to January 1; in Pennsylvania from September 1 to November 30; in Delaware from September 1 to February 1; and in Maryland between September 1 and November 1. In the District of Columbia the redwing is included with the bobolink, and shooting is permitted on Tuesdays, Thursdays, and Saturdays, between August 21 and February 1.

The investigation of the food of blackbirds by the examination of the contents of their stomachs, while confirming to a certain extent the popular estimate of their grain-eating propensities, has shown also that during the season when grain is not accessible these birds destroy immense quantities of seeds of harmful weeds, and that during the whole of the warmer portion of the year, even when grain is easily obtained, they devour a great number of noxious insects. The vegetable portion of the food usually considerably exceeds the animal.

The latter consists mostly of insects,[1] with the addition in a few species of some crustaceans and snails and now and then a small vertebrate. The vegetable food comprises chiefly hard seeds, of which any grain may be taken as a sample. Fruit is eaten by a few species, but not to an injurious extent, and various other vegetable substances are occasionally taken, such as bits of fleshy tubers or roots, mast, mushrooms, etc.

If the blackbirds were to be rated in the order of their grain-eating propensities as shown by stomach examinations, putting those that eat least at the head of the list, they would stand about as follows: Bobolink, redwing, cowbird, rusty blackbird, yellowhead, crow blackbird, boat-tailed grackle, Brewer's blackbird, and California redwing. It is a singular fact that the first two are the ones against which the greatest complaint has been made, thus showing that some factors beside the amount of grain actually eaten by the individual must be taken into account in determining the relative harmfulness of the species. In the case of the bobolink, however, it should be explained that the stomachs upon which the record is founded were nearly all taken in the North, and do not exhibit the bird's rice-eating propensities. Still it is probable that if a proportionate number of stomachs from Southern States were included in the examination there would be no great change in the result. The damage from which the complaint arises is due to the fact that all the bobolinks reared in the Eastern States gather in spring and autumn upon a limited area and attack a single crop—rice. But owing to the comparative shortness of the rice-eating period the amount consumed by each bird must constitute but a small percentage of the food of the year.

The redwing probably owes its bad reputation as a grain eater to its superabundance in the great grain-raising regions of the West. Number of individuals, rather than amount of grain consumed by each, is here probably the important factor. The cowbird, well known as a frequenter of roads and barnyards, is not notorious as a grain eater, and it is probable that the greater part of the 16 percent of grain found in its stomach is waste. The rusty blackbird has not been accused of much damage, and in fact is not in this country at harvest time, so that the greater part of the grain it eats is also probably waste. The yellowhead has gained an unenviable reputation in some parts of the West, and in point of harmfulness is reckoned by the farmers with the redwings, with which it associates. This is not surprising, as nearly 40 per cent of its food is grain; if it were as abundant as the redwing, it would probably be a much greater nuisance than that species. The crow blackbird, while eating a considerable quantity of grain, has not been the cause of so much complaint as the foregoing species, perhaps because of its well-known habit of nesting about farmsteads, where it obtains a large portion of its food from the barnyards and grain cribs. The boat-tailed grackle is so local in its distribution that its food habits are familiar to comparatively few. It confines its grain eating almost exclusively to corn, which it appears to eat at every opportunity. Unlike most of the other species, it also damages fruit. The western Brewer's blackbird, with grain constituting more than 60 percent of its food, would naturally be supposed to be a dangerous neighbor for the grain grower, and where it has come in contact with the grainfield it has fulfilled this expectation. The California redwing is confined to a comparatively small part of the country, and its food habits have not yet received much attention. It seems almost certain that it must become a nuisance, but the record of its food is too meager to justify final conclusions.

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[1] For convenience, spiders and myriapods (thousand-legs) are classed as insects in this investigation.

The animal food of these nine species of blackbirds must be counted for the most part in their favor, as the insects eaten are generally noxious. Only one species (the crow blackbird) shows any special fondness for the valuable predaceous beetles (Carabidæ), and these amount to less than 6 percent of its food. The snout-beetles (Rhynchophora), commonly known as weevils, seem to be specially sought during the early summer. In the five months from April to August, inclusive, 9 percent of the food of the bobolink consists of these harmful beetles, a record which is slightly exceeded by the redwing for the same time. In May they constitute more than one-fourth of the food of Brewer's blackbird. As all the members of this group of beetles are noxious, and as two species that have been identified in great numbers in the birds' stomachs are very harmful to forage crops, the benefit derived from this destruction is obvious. In the consumption of grasshoppers, Brewer's blackbird heads the list, more than 16 percent of its food consisting of these pests; while the redwing (excluding the California bird) stands at the foot, with a little less than 6 percent. In August, Brewer's blackbird takes more than 47 percent of its food in grasshoppers, and the rusty blackbird and cowbird only a little less. Being mainly terrestrial, the blackbirds do not naturally come in contact with caterpillars so frequently as they would if they sought their food upon trees or shrubs; but nevertheless these insects constitute 13 percent of the food of the bobolink, nearly 6 percent of that of the redwing, and but little less of that of several others. The other insects eaten are, with an occasional exception, harmful, and though distributed among several different orders, form a noticeable percentage of the food. The crustaceans and snails may be considered neutral.

In regard to the economic status of the blackbirds, it may be said that the damage done by the redwings and some other species has apparently arisen from the excessive number of individuals rather than from the habits of the species. Thoughtful students of nature have observed that every race or species has a certain high-water mark of abundance, beyond which it can not rise without danger of encroaching upon and injuring other species. This is true of every species, whether at its normal abundance it be beneficial to man or otherwise. The exemplification of this principle is most noticeable in the case of insects, many species of which frequently exceed their ordinary bounds and spread destruction among crops. But the rule is equally applicable to birds; however useful they may be in a general way, it is possible under certain conditions that particular species may become too numerous.

There is no reasonable doubt that in the Mississippi Valley the redwings and yellowheads, and farther west Brewer's blackbird, are much too abundant for the interests of the grain grower. The facilities for nesting afforded by the prairie sloughs and marshes, where for ages these species have been undisturbed, have given rise to such immense hordes that they can in a few hours destroy hundreds of acres of grain, or at least take so much that the remainder is not worth harvesting. Originally the birds obtained their food from wild plants, but with the advent of civilized man and the planting of grain-fields a new source of food was provided. The wild rice (*Zizania aquatica*), which was one of their favorite foods, does not ripen till September, but wheat and oats are ripe from June to August, and are much more abundant and more easily obtained than any of the wild seeds. What wonder that the birds at once availed themselves of this new supply of food spread before them with such a lavish hand! In the early days of settlement the fight near large marshes to save the grain from redwinged blackbirds was as fierce as is now the struggle in the South to save the rice crop from the bobolinks. As the country has become more thickly settled a greater area of grain is sown and the damage is relatively less and more widely distributed. With the further advance of civilization, and the broadening of the area of cultivation, many of the marshes will be drained and the present nesting places will become arable fields. This will necessarily reduce the numbers of the birds, and it is almost certain that in time they will reach the limit at which they are no longer harmful, as is already the case in the Eastern States.

Perhaps the most peculiar case presented by any of our birds is that of the bobolink. Loved and cherished in the North, and there made the subject of poetry and romance, in the South it is execrated and destroyed and conceded but one redeeming quality—that its body is good to eat. In the North it does much good and practically no harm; in the South it becomes a veritable pest. To a person born and reared in New England and taught to regard this bird somewhat as the Hollanders regard the stork, it is an unwelcome duty to pronounce upon it a verdict of condemnation, but the facts force the belief that until some practical method shall be devised to prevent its ravages upon the rice crop there can be no other conclusion than that the good done by the bobolink does not in any appreciable measure counterbalance the harm.

THE BOBOLINK.

(*Dolichonyx oryzivorus.*)

Within the memory of many persons who have passed the half-century mark most of the literature of the bird world available to Americans was that imported from Europe, and stories of the skylark and of the little robin-redbreast were the amusement of their simple childhood. They often wondered why they never saw these birds. But when American writers fully awoke to the beauty and attractiveness of their native birds, tales, both in verse and prose, of birds to be seen every day in our own fields and forests began to find their way into the household. Among these familiar little friends one of the first to be enshrined in song and story was the bobolink.

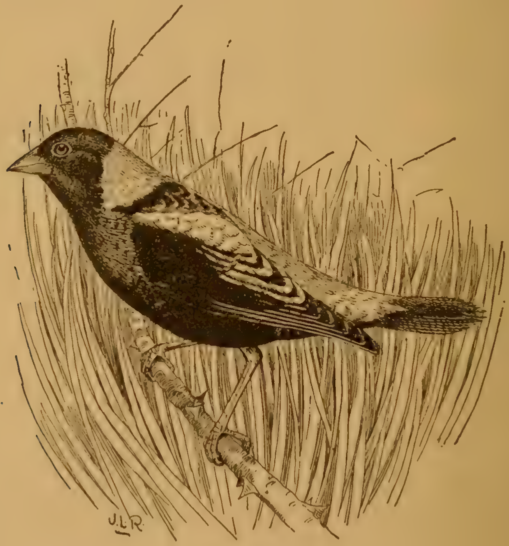

Fig. 1.—Bobolink.

The peculiar difference in the plumage of the two sexes and the idiosyncrasies of the song of the male have long rendered the bobolink a marked bird in its summer home in the Northern States. Few species show such striking contrasts in the color of the sexes, and few have songs more unique and whimsical. Even the early settlers recognized the grotesqueness of some of its notes in their imitative name of 'conquiddle.' In the South it is universally known as the 'ricebird,' from its habit of preying upon rice, while in the Middle States during its southward migration it is called 'reedbird.'

The breeding range of the bobolink is confined to the Transition and Carolinian zones. It occupies the northern part of the United States and the southern part of the British Provinces, extending from the Atlantic to the Rocky Mountains, and locally beyond to eastern Idaho and eastern Nevada (see frontispiece). In winter the bird retires beyond our southern border, ranging southward as far as Brazil. In the last half of April it enters the United States just as the rice is sprouting in Southern rice fields, and at once begins to pull up and feed upon the sprouted kernels. Its stay is short, for this is the season of reproduction, and it hastens northward to enter upon that function.

The nesting usually takes place in a meadow or mowing field, not far from a running brook or spring, and the young are generally upon the wing in the latter part of July. Up to this time they have been fed upon insects, but now the whole family, clad in plain clothes (for the male has lost his bright spring garb), betake themselves to swamps for wild rice, to weed patches for seed, or sometimes to grainfields for oats; but all the time they move slowly toward the South. The small flocks unite; all those that breed in the northeastern part of the country concentrate along the marshes and inlets of the seashore, and the whole body, constantly growing by accessions from other parts of the range, moves steadily southward toward the rice fields—an army vaster than that of Xerxes. The birds begin to arrive upon the rice fields about August 20, and from that time until the last of them wing their way to their winter home, nearly two months later, there is no rest for the unfortunate rice grower. They swarm upon the fields by millions, and when frightened off at one place at once settle upon another a short distance away.

In some of the previous publications on the bobolink the havoc the bird causes among the rice fields of the South does not appear. Audubon mentions its injury to cornfields in Virginia, Maryland, and Pennsylvania, and states that its food consists of grubs, caterpillars, beetles, grasshoppers, crickets, and ground spiders, and the seeds of wild oats (*Zizania aquatica?*), wheat, barley, rice, and other grasses.[1]

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[1] Ornith. Biog., Vol. I, pp. 284–286, 1831.

C. J. Maynard speaks of its feeding in Pennsylvania on a somewhat peculiar grass which springs up after the wheat is harvested and affords abundant food for them during the latter part of October.[1]

Dr. Warren also confines himself to its feeding habits in Pennsylvania. He says:

> The food of these birds during their spring sojourn in Pennsylvania is composed chiefly of different kinds of terrestrial insects, also the seeds of various weeds, grasses, etc. I have examined the stomach contents of twenty-seven Bobolinks * * * and found that eighteen had fed exclusively on beetles, larvæ, ants and a few earthworms; five, in addition to insects and larvæ, showed small seeds, and particles of green vegetable materials, apparently leaves of plants; the four remaining birds revealed only small black and yellow colored seeds. After the breeding season the Reedbirds * * * about the middle of August, again make their appearance in our meadows and grainfields. At this time, although various forms of insects are abundant, they subsist almost entirely on a vegetable diet. They visit the cornfields and * * * prey to a more or less extent on the corn; * * * they tear open the tops of the husk and eat the milky grain. Fields of Hungarian grass are resorted to and the seed eagerly devoured. The different seeds of weeds and grasses which grow so luxuriantly in the marshy swamps and meadows are likewise fed upon with avidity.[2]

In these statements the bird's destructiveness in the South is not considered; but it has been well understood for a long time. Mark Catesby, whose work on the natural history of Carolina contains the first published general account of the birds of this country, says:

> In the beginning of September, while the Grain of Rice is yet soft and milky, innumerable Flights of these Birds arrive from some remote Parts, to the great detriment of the inhabitants. *Anno* 1724, an Inhabitant near Ashley river had forty acres of Rice so devoured by them, that he was in doubt, whether what they had left, was worth the expense of gathering in.
>
> They are esteemed in Carolina the greatest delicacy of all other Birds. When they first arrive, they are lean, but in a few days become so excessive fat, that they fly sluggishly and with difficulty; and when shot, frequently break with the fall. They continue about three weeks, and retire by that time Rice begins to harden.[3]

Wilson says these birds are looked upon by the careful planter as a devouring scourge, and worse than a plague of locusts. In disputing the assertion that they were unknown in this part of the continent previous to the introduction of rice plantations he states that the country produces an abundance of food of which they are no less fond, including insects of various kinds, grubs, May-flies, and caterpillars, young ears of indian corn, and seeds of wild rice (*Zizania aquatica*). He believes, however, that the introduction of rice, and more particularly the progress of agriculture, in this part of America has greatly increased their numbers by multiplying their sources of subsistence fiftyfold within the same extent of country.[4]

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[1] Birds of Eastern N. A., p. 131, 1881.

[2] Birds of Pa., revised ed., p. 207, 1890.

[3] Natural History of Carolina, Vol. I, p. 14, 1731.

[4] Am. Ornith., Edinburgh ed., Vol. I, p. 219, 1831.

It is estimated that the bobolinks, with a little help from the redwings, cause an annual loss of $2,000,000 to the rice growers of the South.[1] Much of this loss is indirect, arising from the necessity of maintaining a corps of men and boys as 'bird-minders,' who patrol the fields from morning till night, firing guns or cracking whips to frighten the birds from the ripening crop. Even then it is impossible to save all the rice, and it often happens that some acres on the borders of the uncultivated marsh where the birds resort are so badly eaten that they are not worth harvesting.

As a rule, the shooting is only to frighten the birds, as the use of shot would cause as much harm to the rice as is done by the birds. The amount of powder consumed in this way is enormous. It is not uncommon to use 100 pounds per annum, and one planter who cultivates a large plantation uses 2,500 pounds in the course of a year.

Col. John Screven, of Savannah, Ga., in writing of the ravages of the ricebird (bobolink), says:

> Its invasions are ruinous to fields on which its flocks may settle, especially if the grain is in palatable condition and in fields adjacent to marshes convenient for ambush or retreat. Bird-minders, armed with muskets and shotguns, endeavor by discharges of blank cartridges to keep the birds alarmed and to drive them from the field. Small shot are also fired among them, and incredible numbers are killed; but all such efforts will not prevent great waste of grain, amounting to a loss of large portions of a field—sometimes, indeed, to its entire loss. The voracity of the birds seems so intense that fear is secondary to it, and they fly, when alarmed, from one portion of the field to another, very little out of gunshot, and immediately settle down to their banquet. * * * The preventives in use against the ravages of the ricebirds have been already suggested, but they are palliative only, applied at great expense, and without commensurate results. * * * In short, no effort yet tried consistent with reasonable economy will drive the ricebird from the field or afford any well-founded promise of their reduction to harmless numbers.

A more specific case of damage is that of a field mentioned by Mr. J. A. Hayes, jr., of Savannah, Ga., which consisted of 125 acres of rice that matured when birds were most plentiful, and which, in spite of 18 bird-minders and 11 half kegs of gunpowder, yielded only 18 bushels per acre of inferior rice, although it had been estimated to yield 45 bushels.

Capt. William Miles Hazzard, of Annandale, S. C., says:

> During the nights of August, 21st, 22nd, 23rd, and 24th, millions of these birds make their appearance and settle in the rice fields. From August 21st to September 25th our every effort is to save the crop. Men, boys and women are posted with guns and ammunition to every four or five acres, and shoot daily an average of about one quart of gunpowder to the gun. This firing commences at first dawn of day, and is kept up until sunset. After all this expense and trouble our loss of rice per acre seldom falls under five bushels, and if from any cause there is a check to the crop during its growth which prevents the grain from being hard but in a milky condition, the destruction of the rice is complete—not paying to cut and bring out of

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[1] Report of Department of Agriculture for 1886, p. 247.

the field. We have tried every plan to keep these pests off our crop at less expense and manual labor than we now incur, and have been unsuccessful. Our present mode is expensive, imperfect and thoroughly unsatisfactory, yet it is the best we can do.

Mr. R. Joseph Lowndes, of Annandale, S. C., in writing of the bobolink and redwing, says:

> I think I am in bounds when I say that one-fourth, if not one-third of the [rice] crop of this river [the Santee] is destroyed by birds from the time the seed is put into the land till the crops are threshed out and put in the barns—I shoot out about 100 kegs of powder every September, with a fair quantity of shot, say 30 to 50 bags, and have killed as high as 150 dozen in a day. In the bird season it takes every man and boy on the plantation to mind these birds. This work has to go on from daylight till dark in any and all weathers and at great expense for six weeks in the fall before the rice is ripe enough for the sickle, and then on till we can get it out of the fields. These birds, if not carefully minded, will utterly destroy a crop of rice in two or three days.

Mr. A. X. Lucas, of McClellanville, S. C., says:

> The annual depredations of the birds are in my opinion equal in this section to the value of the rent of the land—to say nothing of the expense of minding the birds.

Many similar reports of the bobolink's damage to rice have been received by the Biological Survey from Southern rice growers. So destructive are the attacks of these birds that it is necessary to plant the rice previous to their coming in the spring, so that it can be under water when they arrive, and then to plant another lot when they have passed on to the north. This method is adopted not only to avoid the full extent of the ravages of the birds in the spring, but also that the first lot may mature in the fall before the birds return, and the second after they have passed on to their winter home. But it frequently happens that one of the crops is 'in the milk' when the birds arrive in August, in which case it is almost impossible to save it from total destruction.

Mr. Allen C. Zard, of White Hill, S. C., says that when rice is so planted as to 'meet the birds,' that is, to be in just the right stage of maturity when they arrive, and they come in full force, they will destroy the whole crop in spite of powder and shot or anything else.

As a sample of actual loss, the following statement, furnished by Colonel Screven, gives his account with the bobolink at Savannah, Ga., for the year 1885:

Cost of ammunition	$245.50
Wages of bird minders	300.00
Rice destroyed, say 400 bushels	500.00
	$1,045.50

Colonel Screven cultivated in that year 465 acres of tidal land, so that he has estimated a loss of less than 1 bushel of rice to the acre, while most of the rice growers estimate the loss at from 4 to 5 bushels.

Captain Hazzard states that in cultivating from 1,200 to 1,400 acres of rice, he has paid as much as $1,000 for bird-minding in one spring.

In addition to the use of firearms, various other methods of avoiding the ravages of the ricebirds have been tried, but with, at best, indifferent success. To prevent the birds from pulling up the sprouted seed in spring the device of coating it with coal tar has been used, as is effectively practiced in the case of corn. But the method of rice culture is very different from that of corn. As soon as the rice is sown it is covered with water, which remains on the field until the germination of the seed, a period of variable length. The soaking in water so affects the tar coating that it no longer protects the grain, and when the water is withdrawn the birds at once attack the seed. Moreover, it is stated by Captain Hazzard that some birds, including the ricebird, hull the grain before eating it, an assertion apparently corroborated by the absence of hulls in the bobolink stomachs examined that contained rice. (When seeds are swallowed by birds, the hulls usually remain longer in the stomachs than the kernels.) Hence, on this account also, the tar coating would probably have no preventive effect. Another method is to attach small flags to stakes or to fly kites over the fields. Looking-glasses have also been suspended in the same way, but all these devices soon cease to be effective. Placing pieces of refuse meat on poles about the fields to attract the buzzards has been tried; the ricebirds mistake the buzzards for hawks and avoid the fields over which they are flying. But the scheme is effective only for a short time, as the birds soon become accustomed to the presence of the buzzards and pay no further attention to them.

These facts and figures are presented for the consideration of the people of the Northern States, to whom the name 'bobolink' suggests only poetry and sentiment, and by whom the birds themselves are looked upon as almost sacred, and are rigidly protected. It is not probable that any farmer in the North will for a moment contend that he receives from the bobolinks that nest upon his farm so much benefit that he would be willing in return to share the losses inflicted upon his Southern brothers by the birds.

Insect pests ravage the crops of the whole country. No section is exempt from damage. Each crop has its destroyers, against which human energy and science must contend with whatever success they may, and in most cases some effectual remedy has been devised. But the case of the attacks of the bobolink upon the rice crop of the South is unique and is probably the result of a peculiar combination of causes.

As before stated, these birds are inhabitants of open fields; meadows and prairies form their ideal breeding grounds. So much do they avoid woods and groves that they will seldom nest in a well-grown orchard, even if other accompaniments are agreeable. At the time

America was first settled, the whole northeastern part of the country must have presented but few localities, and those of limited area, suited to their wants. When the great forests of New England and New York were cleared away and transformed into farms with extensive areas of mowing land intersected with springs and brooks, the bobolinks were not slow to avail themselves of these new opportunities and soon colonized the whole. At the same time the southeastern coast region was also brought under cultivation, and the tidal and river lands were devoted to the raising of rice, thus furnishing the food needed for the augmented numbers, as noted by Wilson. As settlement, with its attendant clearing away of forests, spread westward, suitable nesting areas were continually added to those already created, and the birds had abundant opportunity for great increase in numbers.

Since the bobolinks pass the winter in South America, the southern coast of Florida naturally presents to most of them the point of departure for the long sea flight to their winter homes. Before reaching this spot, however, they stop to rest and feed in the rice fields of the Southeast, where they remain and recruit their exhausted energies preparatory to final migration. A small contingent, representing those that have nested in the extreme western portion of their range, migrate directly down the Mississippi Valley to the rice fields of Louisiana. When the birds arrive from the North they are in poor condition, having been debilitated by the exertion of reproduction, but they at once begin to recuperate with the abundant food furnished by the rice, soon become very fat, and, after a few weeks' rest, are able to safely resume the southern journey. On the return migration the conditions are similar; the birds arrive from their winter home tired out with their long flight, and find the fields either newly sown with rice or else with the tender blade just appearing above the ground. In each case there is an abundant supply of food, and they are soon in condition to pursue the journey to their northern breeding ground.

Here we see the two causes which have combined to bring about all the trouble between the rice planters and the bobolinks: (1) The fact that the species has probably much increased through the extension of its northern breeding ground, and (2) the fact that the rice fields lie directly in the path of migration, and afford a convenient place for rest and recuperation before and after the flight across the sea. It is almost certain that if the rice fields were far outside of the lines of migration, they would never be molested. It is probable that long before America was discovered the bobolinks gathered in the marshes on the southeastern coast and fed upon wild rice and other wild plants previous to departure for their winter home. Cultivation of the land introduced a more abundant supply of food in the South just at the time it afforded a great increase in nesting area in the North.

In view of the fact that the food habits of the bird during migration are well known, attention has been directed chiefly in the present laboratory investigation to the character of the food taken on the breeding grounds. Of 291 stomachs examined (see p. 72), 231 were obtained from various points in the North, embracing nineteen States, from Massachusetts to Montana, the District of Columbia, and Ontario. They were taken in the five months from May to September, inclusive, but the majority of the September birds whose stomachs have been examined may be regarded as belated migrants. The food for these five months was found to consist of 57.1 percent animal matter and 42.9 percent vegetable. This result would be rather surprising but for the fact that only two of the May and nine of the September stomachs were collected in the rice fields. The general character of the food during the five months is shown in the accompanying diagram (fig. 2).

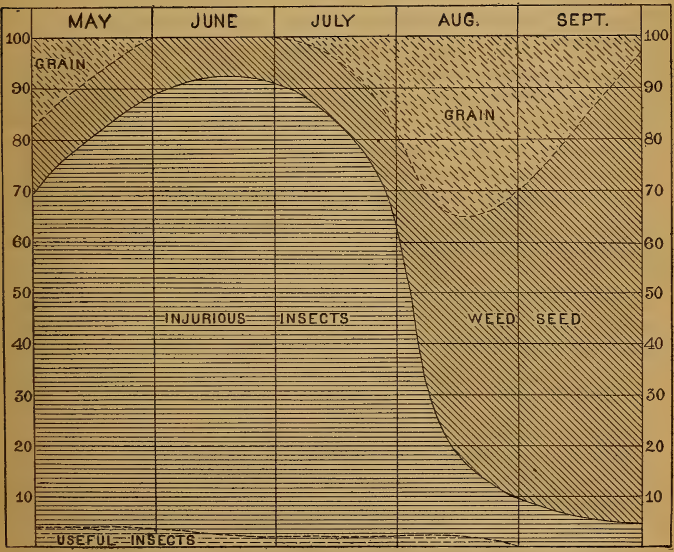

FIG. 2.—Diagram showing proportions of animal and vegetable food of bobolink in each month from May to September inclusive. (The figures in the margins indicate percentages.)

Of the insect food, as determined by the examination, beetles constitute nearly 19 per cent. Predaceous species (Carabidæ), which are, broadly considered, useful insects, are represented only by a trace; snout-beetles, or weevils (Rhynchophora), amount to 8.9 percent, and in May to 20.8 percent; and other beetles, of various families, and all of a more or less harmful character, make up the rest of the coleopterous food. Hymenoptera, represented by ants and some wasps, and by many of the small parasitic species, form 7.6 percent of the food, and were found mostly in May and July stomachs. The bobolink eats more of these useful parasitic Hymenoptera than any other bird whose food habits have thus far been investigated, although it should be stated that examinations of flycatchers and other birds now in course of completion indicate that it will soon lose its position at the head of the list. Caterpillars are apparently a favorite food. They form 17.6 percent of the May food, and rise to 28.1 percent in June, after which they gradually decrease, averaging in the five months 13 per cent. Those eaten are mostly of the species known as cutworms, and include the well-known *Nephelodes violans.* Grasshoppers constitute 11.5 percent of the food, and are eaten principally in June and July, when they amount to 23.2 and 25.8 percent respectively. This is unusual. There seems to be a pretty general law that all birds, no matter what their food habits may be during the rest of the year, eat grasshoppers in August, just as the human race eats certain delicacies in their respective seasons. But in August, when with most birds the grasshopper season is at its height, the bobolinks begin to drop their animal diet and eat vegetable food in preparation for the rice season in the South. Besides the insects already mentioned, a few bugs and flies are eaten, and also some spiders and myriapods.

Of the vegetable food, 8.3 percent consists of oats, most of which are consumed in August, when they reach 31.4 percent of the whole food for the month. Besides oats and rice, little grain is eaten. Wheat and barley were found in a few stomachs, and buckwheat in one. Corn was not found. Weed seeds, such as barngrass, panicgrass, smartweed, and ragweed, are eaten to the extent of 16.2 percent of the food, and like oats are taken mostly in August, when they amount to 36.9 per cent. Various other articles of vegetable food go to make up the diet of the bobolinks, while they remain in the North, the most important of which is wild rice, which seems to be the favorite food during the journey to the rice plantations. This plant is as aquatic as its cultivated relative, and abounds along all the bays, estuaries, and rivers of the Atlantic coast, where it affords food for millions of birds of many species in the latter part of August and during September and later. It was originally, no doubt, the principal food of the bobolinks at this season, and remained so until the advent of civilization introduced something that the birds found even more to their taste. Of the two birds taken in the rice fields in May, one had eaten 55 percent of insects and 45 percent of rice, with a trace of weed seed, while the other had eaten 50 percent of insects, 25 percent of rice, and 25 percent of weed seed. Of the insects, 41 percent in one stomach and 30 in the other were snout-beetles (Rhynchophora). The remainder were harmful beetles of other kinds and caterpillars, except 3 percent of predaceous beetles (Carabidæ) in one stomach and 15 percent of parasitic Hymenoptera (Ichneumonidæ) in the other. Of the nine birds shot in the rice fields in September, one had eaten 15 percent of insects and another 90 percent. The other seven had taken no animal matter, but one had eaten 10, and another 70 percent of weed seed (*Rumex*). All the other food, about 79 percent of the whole, was rice.

SUMMARY.

In a summary of its food habits this species must be treated differently from other birds. It is not enough merely to sum up the noxious insects and weeds destroyed and set them on one side of the account, with the valuable grain eaten on the other, and then strike a balance; though even in this case we should probably decide against the bird, or at least be forced to say, as of the redwing, that its harmfulness is due to an excess of individuals. The case of the bobolink is peculiar. If it preyed upon all kinds of grain or upon any one kind whose cultivation was more general, like wheat or oats, its ravages would be more widely distributed and would consequently fall less heavily upon the individual cultivator; and the damage, although the same, would be more evenly divided and so less appreciated. But instead of this, the attacks of the whole species are directed upon a single crop, and one which is grown over a very limited area and by comparatively few cultivators. Again, unlike most species that remain in the South during the winter and subsist to a great extent upon scattered waste grain, the bobolink makes its attacks at planting time and at or immediately before the full tide of harvest—just when it is capable of doing the greatest damage. The redwing, although it eats rice at harvest, remains through the winter, eating the waste rice, which, if left upon the field, would become what is called 'volunteer' rice—an undesirable element of the crop; but the bobolink in its relations to the rice field has not a single redeeming trait. What aggravates the case is the fact that the birds do not need the rice. There is no reason to suppose that if rice culture were entirely abandoned there would be any diminution in the number of bobolinks. It is altogether probable that if this source of food were withdrawn there would be enough other seed-bearing plants to supply their needs. Bird food is almost always superabundant. It is only under very exceptional circumstances that birds suffer seriously from hunger.

What, then, shall we say of the bobolink? In the life of the writer this bird is associated with some of the happiest and brightest hours of childhood, youth, and maturity. A sunny June morning in rural New England would hardly be complete without the bubbling, gushing, rollicking melody of the bobolink in the mowing lot. But hard facts can not be set aside by poetry and sentiment. The picturesqueness of the bobolink and the melody of its song do not offset the financial loss and harassing care of the Southern rice growers. As the case stands at present the harm done by the bird far outweighs its benefits; but it is to be hoped that science may devise some means by which the rice growers may be relieved from some portion, if not all, of the labor and expense now incident to saving their crops from its devastations.

The following table shows the percentage of each of the principal kinds of food for each month from May to September.

Food of the bobolink.

[NUMBER OF STOMACHS EXAMINED: May, 52; June, 41; July, 45; August, 103; September, 50. Total, 291.]

Food.	May.	June.	July.	August.	September.	Average.
ANIMAL.	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*
Predaceous beetles	1.0	0.7	....	1.3	....	0.6
May-beetle family	12.1	1.5	....	[1] Tr.	....	2.7
Snout-beetles	20.8	9.6	9.6	2.5	2.2	9.0
Other beetles	8.6	12.8	10.7	1.4	0.1	6.7
Wasps, ants, etc	15.5	5.0	13.6	3.5	0.3	7.6
Caterpillars	17.6	28.1	15.3	2.3	1.8	13.0
Grasshoppers	[1] Tr.	23.2	25.8	6.0	2.5	11.5
Other insects	3.5	9.0	8.4	2.0	0.2	4.6
Spiders and myriapods	2.8	2.5	1.1	0.4	....	1.4
Total animal food	81.9	92.4	84.5	19.4	7.1	57.1
VEGETABLE.						
Oats	5.3	....	3.4	31.4	1.6	8.3
Other grain	1.7	....	0.1	4.3	14.6	4.1
Weed seeds	10.0	6.4	9.6	36.9	18.1	16.2
Other vegetable food	1.1	1.2	2.4	8.0	58.6	14.3
Total vegetable food	18.1	7.6	15.5	80.6	92.9	42.9

[1] Tr. = trace.

THE COWBIRD.

(*Molothrus ater.*)

Few rural sights are more suggestive of quiet enjoyment than a group of cows lying at ease in a sunny pasture calmly chewing the cud, while on their backs a small flock of cowbirds are resting or walking slowly about searching for food. Why the birds choose such companions is difficult to explain, as there does not appear to be any special relation between them, but their association with domesticated animals is a matter of common observation, and has given rise to their popular name. Both Audubon and Wilson ascribe the habit to the desire of the birds to feed upon the intestinal worms they find in the cow droppings.[1] But stomach examination, however, entirely fails to bear out this supposition. The insects that annoy the animals do not constitute any considerable portion of the cowbird's food, nor are the seeds upon which it subsists found to any particular extent where cattle range. As the cowbird is abundant in the Mississippi Valley and on the Great Plains, it would be interesting to know if it formerly associated on familiar terms with the buffalo, and such would seem to be the case, as Major Bendire gives 'buffalo bird' as one of its former names.[1]

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[1] Ornith. Biog., Vol. I, p. 498, 1831. Am. Ornith., Edinburgh ed., Vol. I, p. 209, 1831.

The cowbird ranges from the Atlantic to the Rocky Mountains and sparingly beyond nearly to the Pacific, and from the Gulf of Mexico northward into southern Canada. It breeds throughout its range, except in the immediate vicinity of the Gulf.

In winter most of the birds leave the United States and pass into northern Mexico, but a few remain in the Southern States and stragglers may occasionally be found farther north. The southward movement begins in September, and by November 1 the birds have left the Northern States. On their return in spring they appear in the Middle States in March, and by the first week in May have covered their whole summer range. Their great center of abundance is the Mississippi Valley, where they are among the commonest species and second to few in point of numbers. It is a well-known fact that the cowbird, like the European cuckoo, but unlike most other birds, builds no nest for its eggs and young, but saddles the labor of rearing its progeny upon other species into whose nests it introduces its eggs. The birds it selects for this imposition are mostly species smaller than itself, and such as nest in bushes and hedges, or near the borders of woodland; for as the cowbirds inhabit the open country they will not penetrate the depths of the forest. Most of the birds thus imposed upon accept the charge, however reluctantly, and rear the intruder. As the cowbird's egg usually hatches before the eggs of the owner of the nest, the young cowbird begins at once to grow and crowds out, or prevents further incubation of, the other eggs; or, if they are hatched, so monopolizes the food supply that the young soon perish of starvation. This has been observed many times, but whether it is the universal rule has not yet been demonstrated. It is supposed that a female cowbird deposits but one egg in a nest, and that where more than one strange egg is found they are the product of different birds. As many as seven cowbird eggs have been found in one nest. A few birds actively resent the intrusion of the strange egg, and either desert the nest entirely, or build up its sides and lay a new floor, beneath which the unwelcome present is left to decay. This device has, in some cases, been used twice in the same nest, a three-storied structure resulting, in the upper story of which the rightful occupants were finally reared. The sparrows, warblers, and flycatchers are the species most frequently imposed upon, but occasionally larger ones are victimized. Major Bendire enumerates 90 species in whose nests the cowbird's eggs have been found. The largest of these are the mourning dove (*Zenaidura macroura*) and the meadowlark (*Sturnella magna.*)[1] That this parasitic habit is injurious to other species there is no reason to doubt, but the extent of the injury has never been accurately determined.

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[1] Rept. U. S. National Museum for 1893, p. 591, 1895.

It was partly with the expectation of finding some points in the cowbird's character to offset, to some extent, its parasitism that an investigation of its food habits was undertaken. The subject of its food has not attracted much attention from writers upon ornithology; for no great destruction of grain crops has been reported against the cowbird, nor has it ever been accused of preying appreciably upon fruit or garden produce. Dr. B. H. Warren, one of the few ornithologists to make a detailed examination of its food, says:

> The food of these birds consists of seeds, grains, berries and insects. Although Cowbirds subsist to a small extent on wheat and rye, they never, I think, * * * attack these cereals when growing. The seeds of clover, timothy, fox-tailed grass, bitter-weed, etc., are included in their bill of fare; blackberries, huckleberries, cedar berries, wild cherries and the summer grape (*Vitis æstivalis*, Mz.) are eaten. They subsist to a very great extent, however, on insects; large numbers of grasshoppers, beetles, grubs and "worms" are eagerly devoured.[2]

Maj. Bendire enumerates, as among the articles of cowbird diet, ragweed, smartweed, foxtail or pigeon grass, wild rice and the smaller species of grains, berries of different kinds, grasshoppers, beetles, ticks, flies, and other insects, worms, etc., and adds: "Taking its food alone into consideration it does perhaps more good than harm."[3]

A collection of 544 stomachs has been received by the Biological Survey from twenty States ranging from Maine south to Virginia and west to Kansas and the Dakotas, and also from Tennessee, Georgia, Texas, Arizona, the District of Columbia, and Canada (see p. 73). Every month in the year is represented, though only three stomachs were taken in January. The total food found in these stomachs was divided as follows: Animal matter, 22.3 percent; vegetable, 77.7 percent. The proportions in different months are shown by the accompanying diagram (fig. 3). Only a little more than 3 percent of the stomach contents was sand or gravel—a very small amount when the large proportion of vegetable food is considered. The animal food consists almost entirely of insects and spiders, a few snails forming the exceptions. The insects comprise wasps and ants (Hymenoptera), bugs (Hemiptera), a few flies (Diptera), beetles (Coleoptera), grasshoppers (Orthoptera), and caterpillars (Lepidoptera). Wasps, ants, and flies, especially the last, are the insects that might be supposed to attract the birds to the cattle, but the stomachs do not show that many are eaten, for altogether they amount to less than 3 percent of the food, and the wasps and ants are the most important constituents of this percentage. The wasps are probably picked from flowers while gathering honey and the ants are collected from the ground. The destruction of the latter is a decided benefit and the former can be spared. Hemiptera are represented in the stomach by stink-bugs (Pentatomidæ), leaf-hoppers (Jassidæ), and one cicada. While some of the pentatomids are useful insects, because of their habit of preying upon others of a noxious character, many of them are serious pests; so on the whole it is probable that birds do little harm by eating them. The so-called leaf-hoppers live to a great extent upon grass and might very properly be called grasshoppers were it not that that name has been appropriated for other insects. Those eaten are so little that it would require a number of them to fill the stomach of even a small bird. All are harmful, and some, as for example those that feed on the grapevine and rose, are very injurious. Cowbirds eat a great many of these leaf-hoppers, which in some stomachs amount to 60 percent of the whole contents. The greater number are eaten in June and July, but the aggregate for the year is small, about 1½ percent.

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[1] Rept. U. S. National Museum for 1893, p. 594, 1895.

[2] Birds of Pennsylvania, revised ed., p. 210, 1890.

[3] Life Histories of N. A. Birds, II, Special Bul. No. 3, U. S. National Museum, p. 435, 1895.

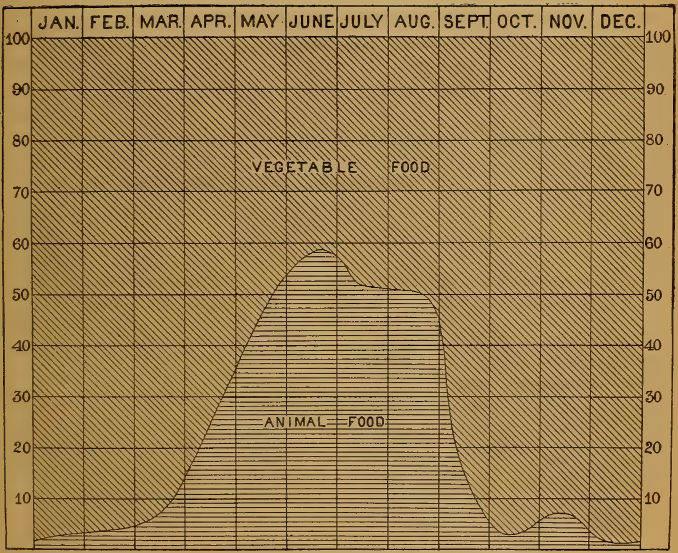

FIG. 3.—Diagram showing proportions of animal and vegetable food of cowbird in each month of the year. (The figures in the left margins indicate percentages.)

Beetles form 5.3 percent of the year's food. The predaceous ones, or those that prey to a greater or less extent on other insects (Carabidæ and a few Cicindelidæ), although living on the ground and often found by cowbirds, are rarely eaten, the aggregate for the year being about three-fourths of one percent of the whole food. Of the eight families of beetles represented in the food, only one group, the snout-beetles or weevils (Rhynchophora), are eaten to any noticeable extent, and these amount to little more than 2 percent of the food of the year, although in June they rise to more than 9 percent. They belong mostly to the families of scarred snout-beetles (Otiorhynchidæ), curculios (Curculionidæ), and 'bill bugs' (Calandridæ), and as they are all potentially harmful and most of them actual pests, their destruction is a benefit to agriculture. The rest of the beetle food, comprising species that are all more or less injurious, amounts to a little more than 2 percent, and is taken chiefly in April, May, and June.

Grasshoppers appear to be the cowbirds' favorite animal food, and compose almost half of the insect food, or 11 percent of the whole. They are first taken in March, when the birds return from their winter home, reach a maximum of 45.1 percent in August, and decrease to 6.2 percent in November. This is a large record, compared with those of most other birds whose food has been accurately determined. It is much greater than those of the crow, crow blackbird, or red-winged blackbird, all noted ground feeders, and is exceeded only by those of the meadowlark and a few of other families.

Caterpillars are eaten to some extent in every month of the cowbirds' stay in the North, but do not constitute a very important element of the food, averaging only a little more than 2 percent of the whole. The greatest number, amounting to a little more than 10 percent, are eaten in May. The notorious army worm (*Leucania unipuncta*) was identified in four stomachs, and was probably contained in many more, but not in a condition to be recognized. One small moth and one ephemerid were also found.

Spiders were found in many stomachs, but not in large numbers. They seem to be eaten wherever they are found, but probably only terrestrial species are taken. Snails were found in a number of stomachs.

Eggshells occurred in several stomachs, but in such small quantities as to preclude the probability that they were taken from the nests of other birds. When young birds are hatched the parents remove the eggshells and drop them at some distance from the nest, where, doubtless, they are found and eaten by other birds, for bits of eggshell appear more or less frequently in the stomachs of nearly every species examined.

The vegetable food of the cowbird exceeds the animal food, both in quantity and variety. When searching the ground about barnyards or roads the bird is evidently looking for scattered seeds rather than insects, though the latter are probably taken whenever found. Various other substances are also eaten, but they are mostly of the same general character, such as hard seeds of grasses or weeds, with but little indication of fruit pulp or other soft vegetable matter. The following table shows the various grains and seeds identified, with the number of stomachs in which they were contained:

Vegetable substances found in stomachs of cowbirds.

	Stomachs.
Grain:	
Corn	56
Wheat	20
Oats	102
Buckwheat	1
Fruit:	
Blueberry (*Vaccinium*)	1
Raspberry (*Rubus*)	4
Forage:	
Clover (*Trifolium*)	8
Timothy (*Phleum*)	8
Sorghum (*Andropogon sorghum*)	2
Weeds:	
Ragweed (*Ambrosia*)	176
Knotweed (*Polygonum*)	49
Sorrel (*Rumex*)	37
Thistle (*Carduus*)	1
Amaranth (*Amaranthus*)	11
Mustard (*Brassica nigra*)	4
Chickweed (*Alsine*)	9
Weeds—Continued.	
Pennyroyal (*Trichostema dichotomum*)	2
Mouse-ear chickweed (*Cerastium*)	2
Plantain (*Plantago*)	1
Sunflower (*Helianthus*)	8
Gromwell (*Lithospermum*)	4
Blue-eyed grass (*Sisyrinchium bermudiana*)	1
Barngrass (*Chœtochloa*)	265
Panic-grass (*Panicum*)	133
Joint-grass (*Paspalum*)	22
Yard-grass (*Eleusine indica*)	2
Unidentified (mostly unknown grass seeds)	57
Miscellaneous:	
Mast	1
Leaf gall	2
Rubbish	5

Oats are apparently the favorite grain with the cowbird, as they were found in 102 stomachs, a record which exceeds the total of those containing either wheat or corn. They first appear in March, when 12.9 per cent are eaten, evidently waste grain picked up in the stubble-fields, highways, and barnyards, except in the southern part of the country, where sowing may take place as early as this month. Oats constitute less than 2 per cent in April, nearly 8 percent in May (probably partly made up of grain from newly sown fields), 3.7 in June, 25.1 in July, 31.5 in August, 19.4 in September, and after that decrease rapidly and reach zero before the 1st of November. The average consumption for all the months of the year is 8.6 percent. Corn was found in 56 stomachs, but the irregular manner in which it is distributed through the food of the year indicates that it is not a favored diet. The record for January, which shows a little more than 33 per cent, is based on only 3 stomachs, and so can not be considered very reliable. In any case the corn eaten must have been scattered grain, unless it was some that had been left in the shock over winter. Even in October, when corn is abundant everywhere, it is scarcely touched. Only 1 bird out of 70 taken in that month had eaten any, and in this single instance it amounted to only 6 percent of the entire food. In the other months the quantity ranges downward to zero, but in such an erratic manner as to indicate that it is never sought, but merely eaten when found and when better food is not at hand. The aggregate for the year is 6.5 percent. Wheat was found in only 20 stomachs, and amounts to 1.4 percent of the year's food. Like corn, its distribution is irregular and does not appear to have any relation to the seasons. It is probable that it is a purely accidental food, eaten only when nothing better is to be had. The greatest quantity (4.8 percent) was taken in September. A single kernel of buckwheat was found in 1 stomach.

Grain as a whole amounts to 16.5 percent, or practically one-sixth of the food of the year; but a consideration of its distribution as given above leads to the conclusion that a large portion of this, probably one-half, is waste. In comparing the record of the cowbird with that of the red-winged blackbird, the cowbird's shows the greater consumption of grain; that is, 16.5, as against 13.9 for the redwing. In view of this fact it would seem somewhat strange, were not a large proportion of the grain consumed waste, that no complaints should have been made against the cowbird on the score of grain eating. It is possible, of course, that observers have not always distinguished the two species in the field, as male cowbirds do not differ greatly in color or size from female redwings—and their great abundance in the West lends some color to this supposition. But it seems far more probable that they gather a very important part of the grain found in their stomachs in their gleaning in roads, about barnyards, and wherever cattle are found, and so do far less actual damage to growing crops than the redwings.

Fruit forms an insignificant part of the food. Some traces of what may have been fruit pulp were found, and a few seeds of raspberries were in each of 4 stomachs, and some blueberry seeds in one; but as some of the raspberry seeds were in stomachs collected in April they were evidently eaten as dry seeds, and this may have been true of all.

The seeds of plants classified as weeds in the list of vegetable food constitute by far the most important part of the diet. They form the largest item of food in every month except July and August, and are of importance in every month. Beginning with 64.4[1] percent in January and 95.5 percent in February, they slowly decrease to 16.6 percent in August, but rise suddenly to 58.1 percent in September, attain their maximum of 97 percent in October, and end with 96.8 percent in December. They constitute practically the whole food of the winter months. The aggregate for the year is 60 percent of all the food, or more than three-fourths of the vegetable food, and more than three and a half times the total amount of grain. Barngrass and ragweed are especially well known as troublesome weeds throughout the country wherever field crops are cultivated, and these two constitute the great bulk of this food. Barngrass seed was found in 265 stomachs and ragweed in 176. Panicums, while ostensibly forage plants, are often troublesome weeds. Their seeds were found in 133 stomachs, which shows that the birds relish them. Knotweed, smartweed, and other species of the genus *Polygonum*, all noted weeds, were found in 49 stomachs. The other items of the weed-seed food are eaten to a greater or less extent, but not by so many birds as are those specifically mentioned. Of the 544 stomachs only 2 were filled with grain alone, while 94 contained nothing but weed seed. The amount of weed seed destroyed by birds in a single year in the United States is immense, and it is evident that the cowbird is one of the noteworthy agents by which the already overflowing tide of noxious weeds is kept within its present limits.

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[1] Based on 3 stomachs. A larger number would probably greatly increase the percentage.

SUMMARY.

In summing up the results of the investigation, the following points may be considered as fairly established: (1) Twenty per cent of the cowbirds' food consists of insects, which are either harmful or annoying. (2) Sixteen per cent is grain, the consumption of which may be considered a loss, though it is practically certain that half of this is waste. (3) More than 50 per cent consists of the seeds of noxious weeds, whose destruction is a positive benefit to the farmer. (4) Fruit is practically not eaten.

The following table shows the percentage of each of the principal kinds of food for every month in the year:

Food of the cowbird.

[NUMBER OF STOMACHS EXAMINED: January, 3; February, 10; March, 18; April, 83; May, 99; June, 53; July, 57; August, 38; September, 79; October, 70; November, 23; December, 11. Total, 544.]

Food.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Predaceous beetles	......	......	......	1.1	3.9	1.6	1.5	......	......	......	......	0.4	0.7
Other beetles	0.3	2.4	2.4	10.2	12.3	16.5	8.1	1.7	0.8	0.1	[1]Tr.	......	4.6
Grasshoppers	......	......	2.9	5.8	10.7	20.3	29.7	45.1	9.4	1.8	6.2	......	11.0
Caterpillars	1.3	1.3	2.1	5.2	10.3	3.8	2.2	0.3	0.3	[1]Tr.	......	......	2.2
Other insects	0.7	0.6	1.0	0.8	2.4	9.8	7.2	2.4	2.2	[1]Tr.	0.1	0.3	2.3
Spiders and myriapods	......	0.2	......	2.5	2.2	4.8	2.9	0.9	0.3	[1]Tr.	......	......	1.1
Other animal food	......	......	0.2	0.1	0.9	2.3	0.5	0.1	[1]Tr.	......	......	......	0.4
Total animal food	2.3	4.5	8.6	25.7	42.7	59.1	51.9	50.5	13.0	1.9	6.3	0.7	22.3
VEGETABLE.													
Grain	33.3	......	31.3	7.1	15.7	12.9	27.2	31.7	28.9	1.1	6.1	2.5	16.5
Weed seeds	64.4	95.5	49.1	66.1	41.5	28.0	19.2	16.6	58.1	97.0	87.6	96.8	60.0
Other vegetable food	......	......	11.0	1.1	0.1	......	1.7	1.2	......	......	......	......	1.2
Total vegetable food	97.7	95.5	91.4	74.3	57.3	40.9	48.1	49.5	87.0	98.1	93.7	99.3	77.7

[1] Tr. = trace.

In view of the fact that so much has been said in condemnation of the cowbird's parasitic habits, it may not be out of place to inquire whether this parasitism is necessarily as injurious as has been claimed. When a single young cowbird replaces a brood of four other birds, each of which has food habits as good as its own, there is, of course, a distinct loss; but, as already shown, the cowbird must be rated high in the economic scale on account of its food habits, and it must be remembered that in most cases the birds destroyed are much smaller than the intruder, and so of less effect in their feeding, and that two or three cowbird eggs are often deposited in one nest.

The question is a purely economic one, and until it can be shown that the young birds sacrificed for the cowbirds have more economic value than the parasite, judgment must be suspended.

THE YELLOW-HEADED BLACKBIRD.

(*Xanthocephalus xanthocephalus.*)

The yellow-headed blackbird is locally distributed throughout the Western United States, where it frequents marshes and sloughs, but avoids the more arid deserts, extensive forests, and wooded mountains. Its range in summer extends from southern California through northern Arizona and New Mexico to Indiana, and northward into the Canadian Provinces. It winters in the southern part of its range and on the table-lands of Mexico. Stragglers have been found from Greenland to Cuba.

Its breeding habits are much like those of the redwing, but it is usually less abundant than that bird. It is gregarious and resorts to marshes to build its nest, which is very similar to that of the redwing, and similarly placed. Although it breeds in marshes, it does not by any means confine itself to them in its search for food, but forages far afield, visiting corncribs, grainfields, and barnyards. The writer's first experience with the yellow-headed blackbird was on the prairies of Nebraska, where flocks visited the railway then in process of construction, running about among the feet of the mules and horses in search of grubs and worms exposed by the plow and scraper, and all the time uttering their striking guttural notes (almost precisely like those of a brood of suckling pigs). In their habit of visiting barnyards and hog pastures they resemble cowbirds much more than redwings. When the breeding season is over they often visit grainfields in large flocks, and become the cause of much complaint by Western farmers.

The investigation of their food is founded upon an examination of 138 stomachs received from ten of the Mississippi Valley States, and from California and Canada, and collected during the seven months from April to October, inclusive (see p. 73). While decidedly too few to give entirely reliable results, they may furnish some preliminary data regarding the food. As indicated by the contents of these stomachs, the food for the seven months consists of 33.7 percent of animal (insect) matter and 66.3 percent of vegetable matter. The animal food is composed chiefly of beetles, caterpillars, and grasshoppers, with a few of other orders, while the vegetable food is made up almost entirely of grain and seeds of useless plants. Predaceous beetles (Carabidæ) constitute 2.8 percent of the season's food, a very small amount for a bird of such pronounced terrestrial habits. Most of these beetles are eaten in May, June, and July, and none are taken in the fall months. Other beetles amount to a little more than 5 percent, and are eaten mostly in the early part of summer. Caterpillars constitute 4.6 percent, but nearly two-thirds of them are taken in July, and in that month they form 21.5 percent of the month's food. Remains of the army worm (*Leucania unipuncta*) were identified in 6 stomachs. Grasshoppers are first eaten in May, but do not amount to any important percentage until July, the month of maximum consumption. In this respect this bird appears to differ, like the bobolink, from most other species, as August is usually the month in which grasshoppers are eaten most freely; but the examination of a larger number of stomachs might prove the yellowhead to be no exception to the usual rule. After August the consumption of grasshoppers is considerably increased, and the total for the season is 11.6 percent. The remainder of the animal food, 9.7 percent, is made up of other insects, chiefly Hymenoptera (ants, wasps, etc.), with a few dragonflies and an occasional spider and snail.

So far as its animal food is concerned, the yellowhead has a very good record. For a ground feeder, it takes very few predaceous beetles, while insects harmful to vegetation constitute 30 percent of its food.

The vegetable food consists almost entirely of seeds, and for economic purposes may be divided into grain and weed seed. Of grain, oats hold first place, as in the food of the redwing, and are probably eaten in every month when they can be obtained, although none were found in any of the 5 stomachs taken in September. The 3 October stomachs contained an average of 63 percent, but a greater number of stomachs would in all probability give a smaller average. August, apparently the next month of importance, shows 43.2 percent. Next to oats corn is the favorite grain, and was eaten to the extent of 9.8 percent, nearly all in the months of April, May, and June, with a maximum of 48.8 percent in April, when no wheat was eaten. Wheat appears from May to August, inclusive, and is the only vegetable food that reaches its highest mark in August. The average for the season is 3.5 percent.

Grain collectively amounts to 38.9 percent, or considerably more than half of the total vegetable food, and more than one-third of all the food. While there is no doubt that a considerable quantity of this is waste, still a very decided taste for grain is shown, a point that is more especially emphasized by the large quantity (more than 54 percent of the total food) eaten in August. Corn, from its appearance in such large quantities in the food of the early spring months, is evidently picked up as waste grain to a considerable extent, but oats and wheat, which appear at the same time, are probably largely taken from newly sown fields. In July and August they evidently come from harvest fields. Mr. E. W. Nelson, of the Biological Survey, informs the writer that from about the last of August to the end of September the cornfields of the table-lands of Mexico are much damaged by yellowheads.

Weed seed appears as a very prominent item of food in every one of the seven months under consideration, except October, the record for which is based on only 3 stomachs and hence can not be made a basis for sound conclusions. Beginning with 18 percent in April, it increases to 34 percent in June, drops to 6.6 in July (to make room for caterpillars and grasshoppers), rises to 36.1 percent in August, and finally to 64.4 percent in September. While, as stated above, none was found in the 3 October stomachs, there is no reason to doubt that weed seed is not only a common article of food in that month but also a staple diet in the other colder months of the year. It is to be regretted that no stomachs of the yellowhead have been received from its winter range, to give some idea of its food during the colder season. It is almost certain, however, that this would be found to consist of weed seed and waste grain, as in the case of its neighbor, the redwing. The weeds found in the stomachs are almost precisely the same as those eaten by the redwings, and in practically the same proportions. Barngrass (*Chætochloa*), *Panicum*, and ragweed (*Ambrosia*) are the leading kinds, supplemented by *Polygonum*, *Rumex*, and others.

SUMMARY.

From this brief review some conclusions may be drawn, but the somewhat fragmentary nature of the evidence makes it probable that they may be subject to considerable modification in future. It is almost certain that the rather peculiar distribution of the various items of food through the season will prove to be more apparent than real in the light of more extensive observations. In the meantime we may safely conclude (1) that the yellowhead feeds principally upon insects, grain, and weed seed, and does not attack fruit or garden produce; (2) that it does much good by eating noxious insects and troublesome weeds, and (3) that where too abundant it is likely to be injurious to grain.

When it is considered that the redwing has been accused of doing immense damage to grainfields, it is evident that the yellowhead, which has been found to eat nearly three times as much grain as the former, must be capable of much mischief in localities where it becomes superabundant.

The following table shows the various elements of the food for each month of the season:

Food of the yellow-headed blackbird.

[NUMBER OF STOMACHS EXAMINED: April, 9; May, 31; June, 14; July, 16; August, 60; September, 5 October, 3: total, 138.]

Food.	April.	May.	June.	July.	August.	September.	October.	Average.
ANIMAL.	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*
Predaceous beetles	2.7	8.0	4.1	4.7	0.1	....	....	2.8
Other beetles	3.9	12.6	7.8	7.8	0.7	....	2.3	5.0
Caterpillars	0.1	6.0	4.4	21.5	0.1	....	....	4.6
Grasshoppers	....	1.0	0.4	32.0	8.0	15.6	24.3	11.6
Other insects	2.6	5.3	22.6	6.9	0.8	19.0	10.4	9.7
Total animal food	9.3	32.9	39.4	72.9	9.7	34.6	37.0	33.7
VEGETABLE.								
Corn	48.8	9.0	9.7	....	1.1	....	....	9.8
Wheat	....	5.7	3.4	5.8	9.9	....	....	3.5
Oats	23.9	21.9	12.8	14.4	43.2	....	63.0	25.6
Weed seed	18.0	30.5	34.0	6.6	36.1	64.4	....	27.1
Other vegetable food	....	....	0.7	0.3	....	1.0	....	0.3
Total vegetable food	90.7	67.1	60.6	27.1	90.3	65.4	63.0	66.3

THE RED-WINGED BLACKBIRD.

(*Agelaius phœniceus.*)

The red-winged blackbird (otherwise known as the red-shouldered blackbird, swamp blackbird, and American starling), including its various races,[1] inhabits North America from Nova Scotia and Great Slave Lake south to Costa Rica. It breeds throughout its range in the United States and Canada. The typical form is replaced at different places in the southern part of the range by the Bahama, Florida, and Sonoran redwings, but the differences that separate these various subspecies are scarcely appreciable by the casual observer. The bird is curiously restricted in its local distribution by the fact that it nests as a rule only in the immediate vicinity of water, and preferably directly over it. For this reason it is absent from extensive tracts of country either in high mountainous regions or in desert or forest areas. Nests have occasionally been found in perfectly dry situations at a distance from water, but such cases are exceptional.

The prairies of the Upper Mississippi Valley, with their numerous sloughs and ponds, furnish ideal nesting places for redwings, and consequently this region has become the great breeding ground for the species. In many places, especially on the borders of shallow lakes, thousands of acres of rushes and reeds of various kinds afford nesting sites for redwings, yellowheads, and marsh wrens, while myriads of more aquatic species swim in the waters below and nest amid the broken herbage. It is from such breeding grounds that the vast flocks are recruited that make such havoc upon fields of grain and call forth the maledictions of the unfortunate farmer. East of the Appalachian Range the conditions are different. Marshes on the shores of lakes, rivers, and estuaries are here the only sites available for breeding purposes, and as these are more restricted in number and area than the western breeding grounds the species is much less abundant than in the West.

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[1] The different subspecies are not considered separately in this bulletin.

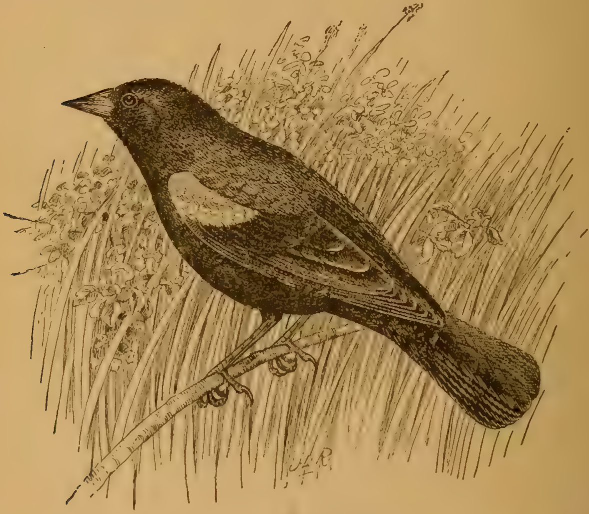

FIG. 4.—Red-winged blackbird.

Like their associates, the marsh wrens, and their neighbors, the bank swallows, the redwings are eminently gregarious, living in flocks for the greater part of the time and breeding in communities which vary in size according to the area of the swamp they occupy. Sometimes these colonies are reduced to a single family, which in such cases usually consists of one male bird with several females and their nests; for this species practices polygamy, a habit noted in the case of only a few species of song birds.

During the winter the redwings are in the South, but may occasionally be found as far north as latitude 40°, and stragglers may occur at any point within their summer range. (A young male was shot by the writer in central Iowa in January, 1879, and one bird whose stomach is included in this investigation was killed in northern Massachusetts on January 29, 1896.) In their northward migration they begin to appear in the Upper Mississippi Valley about the last of February or during the first half of March, and by the middle of March enter the New England States. On the return journey they begin to leave the more northern portions of their range in September, and the migration is practically complete by the end of October.

Although they arrive from the South at an early date, they are by no means early breeders, for at that time the marshes are desolate wastes of dead and broken-down herbage, and the birds do not build until the new growth is considerably advanced. This involves a delay of several weeks, during which the birds, having taken possession of a marsh where they intend to construct their homes, sit idly about and behave as though time hung heavily upon them. The females usually perch upon the dead vegetation as if watching for the new growth to appear, while their liege lord, with the resplendent insignia of his rank conspicuous on his shoulders, struts about upon some fence or tree and swells his little body, ruffles up his feathers, and by a display of his brilliant colors and a rather poor attempt at singing tries to make the time less wearisome to his patient mates.

Owing to their peculiar nesting habits these birds do not come in contact with the farmers' crops appreciably during the breeding season, since at this time they confine themselves to the immediate vicinity of their marshy homes. After the season of reproduction they assemble in flocks, usually of a considerable size and often immense, and it is at this time that they frequently do serious harm to crops of standing grain. Much testimony has been received by the Department of Agriculture indicating that the damage is sometimes enormous. In letters received from the rice growers in the South the redwing is implicated equally with the bobolink in destroying rice both in spring and fall. It is claimed by some, however, that the redwing is not wholly bad, as it remains in the fields during the winter and eats the 'volunteer' rice, which, if it grew in any considerable quantity, would spoil the crop.

On the other hand, there is considerable evidence that redwings eat a great many insects, and that it is only under exceptional circumstances that they eat grain to an injurious extent. It is noticeable that nearly all complaints against them come from the Mississippi Valley, where the native grasses and weeds of the prairies have been replaced by vast fields of grain. It has also been stated that the greatest damage was done when but few fields of grain had been planted. These afforded a new and easily accessible supply of food of which the birds were not slow to avail themselves; but since the grainfields have increased in area the work of the birds has become more widely distributed, and the damage has not been so apparent.

Wilson, in speaking of the food of the redwing, says:

> The whole season of winter, that, with most birds, is passed in struggling to sustain life in silent melancholy, is, with the redwings, one continued carnival. The profuse gleanings of the old rice, corn, and buckwheat fields, supply them with abundant food, at once ready and nutritious. * * * Before the beginning of September, these flocks have become numerous and formidable; and the young ears of maize, or Indian corn, being then in their soft, succulent, milky state, present a temptation that can not be resisted. Reenforced by numerous and daily flocks from all parts of the interior, they pour down on the low countries in prodigious multitudes. Here they are seen, like vast clouds, wheeling and driving over the meadows and devoted cornfields, darkening the air with their numbers. Then commences the work of destruction on the corn, the husks of which, * * * are soon completely or partially torn off; while from all quarters myriads continue to pour down like a tempest, blackening half an acre at a time; and, if not disturbed, repeat their depredations till little remains but the cob and the shriveled skins of the grain; what little is left of the tender ear, being exposed to the rains and weather, is generally much injured. * * *
>
> It has been already stated, that they arrive in Pennsylvania late in March. Their general food at this season, as well as during the early part of summer, * * * consists of grubworms, caterpillars, and various other larvæ, the silent, but deadly enemies of all vegetation, and whose secret and insidious attacks are more to be dreaded by the husbandman than the combined forces of the whole feathered tribes together. For these vermin, the starlings search with great diligence; in the ground, at the roots of plants, in orchards, and meadows, as well as among buds, leaves, and blossoms; and from their known voracity, the multitudes of these insects which they destroy must be immense. Let me illustrate this by a short computation: If we suppose each bird, on an average, to devour fifty of these larvæ in a day, (a very moderate allowance,) a single pair, in four months, the usual time such food is sought after, will consume upward of twelve thousand. It is believed, that not less than a million pair of these birds are distributed over the whole extent of the United States in summer; whose food, being nearly the same, would swell the amount of vermin destroyed to twelve thousand millions. But the number of young birds may be fairly estimated at double that of their parents; and, as these are constantly fed on larvæ for at least three weeks, making only the same allowance for them as for the old ones, their share would amount to four thousand two hundred millions; making a grand total of sixteen thousand two hundred millions of noxious insects destroyed in the space of four months by this single species! The combined ravages of such a hideous host of vermin would be sufficient to spread famine and desolation over a wide extent of the richest and best cultivated country on earth. All this, it may be said, is mere supposition. It is, however, supposition founded on known and acknowledged facts. I have never dissected any of these birds in spring without receiving the most striking and satisfactory proofs of these facts; and though, in a matter of this kind, it is impossible to ascertain precisely the amount of the benefits derived by agriculture from this, and many other species of our birds, yet, in the present case, I can not resist the belief, that the services of this species, in spring, are far more important and beneficial than the value of all that portion of corn which a careful and active farmer permits himself to lose by it.[1]

Audubon, in speaking of this species, says:

> The marsh blackbird is so well known as being a bird of the most nefarious propensities, that in the United States one can hardly mention its name, without hearing such an account of its pilferings as might induce the young student of nature to conceive that it had been created for the purpose of annoying the farmer. That it

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[1] Am. Ornith., Edinburgh ed., Vol. I., pp. 193–198, 1831.

> destroys an astonishing quantity of corn, rice, and other kinds of grain, cannot be denied; but that before it commences its ravages, it has proved highly serviceable to the crops is equally certain. * * *
>
> Their food at this season [spring], is almost exclusively composed of grubs, worms, caterpillars, and different sorts of coleopterous insects, which they procure by searching with great industry, in the meadows, the orchards, or the newly plowed fields. * * * The millions of insects which the redwings destroy at this early season, are, in my opinion, a full equivalent for the corn which they eat at another period.[1]

Of more recent writers, probably Dr. B. H. Warren has made the most extensive researches upon the food habits of these birds. In stating the results of the examination of 25 stomachs, he says:

> The redwing * * * destroys large numbers of "cutworms." I have taken from the stomach of a single swamp blackbird as many as 28 "cutworms." In addition to the insects, etc., mentioned above, these birds also, during their residence with us, feed on earth-worms, grasshoppers, crickets, plant-lice and various larvæ, so destructive at times in the field and garden. During the summer season, fruits of the blackberry, raspberry, wild strawberry, and wild cherry are eaten to a more or less extent. The young, while under parental care, are fed exclusively on an insect diet.[2]

N. S. Goss says of the redwings:

> During the fall and winter months they assemble in large flocks, and do much damage in the ricefields, and are often more or less injurious to the grains within their summer homes; but the damage they do in the latter case is overbalanced by the destruction of injurious insects, upon which they almost wholly feed during the breeding season; busy hunters of the field and followers of the plow.[3]

Stomach examination does not indicate that the redwings are especially fond of grain. The diagram here given (fig. 5) illustrates the variation in the relative proportions of the more important elements of the food throughout the year. The preponderance of weed seeds over grain or other vegetable food is apparent at a glance. Weed seeds, such as *Chætochloa* (*Setaria*), *Ambrosia*, *Rumex*, *Polygonum*, etc., constitute more than half the food of the year, while grain (nearly half oats) is less than one-seventh. The only varieties of *Chætochloa* that are cultivated extensively are Hungarian grass and millet, but as these are raised to a great extent as forage plants no great harm is done by taking the seed, except when it is newly sown or where the crop is raised for seed alone. The other species are all noxious weeds, and probably the greater part of the *Chætochloa* eaten by birds is from wild plants, which are as much of a nuisance as any of the other weeds when they get into cultivated fields. In the matter of fruit the redwings are almost total abstainers, only on rare occasions tasting a blackberry or some other of the smaller varieties by way of experiment.

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[1] Ornith. Biog., Vol. I, pp. 348–349, 1831.

[2] Birds of Pennsylvania, revised ed., p. 212, 1890.

[3] History of the Birds of Kansas, p. 399, 1891.

The increase of vegetable food other than grain and weed seeds during August and September is due to the consumption of wild rice (*Zizania aquatica*), which at this time forms quite an important item.

In their insect diet the redwings do much good, for only a small proportion of the species they eat are beneficial. More destructive snout-beetles (weevils) are eaten by them than by any other birds that the writer has examined, with the single exception of the bobolinks. Other beetles and grasshoppers also constitute an important part of the insect food. While there can be no doubt that the birds do considerable damage when collected in large flocks, it is probable that such injury will become less and less as the area of cultivation increases and the swamps where they breed are encroached upon and drained, with a consequent reduction in the abundance of the species.

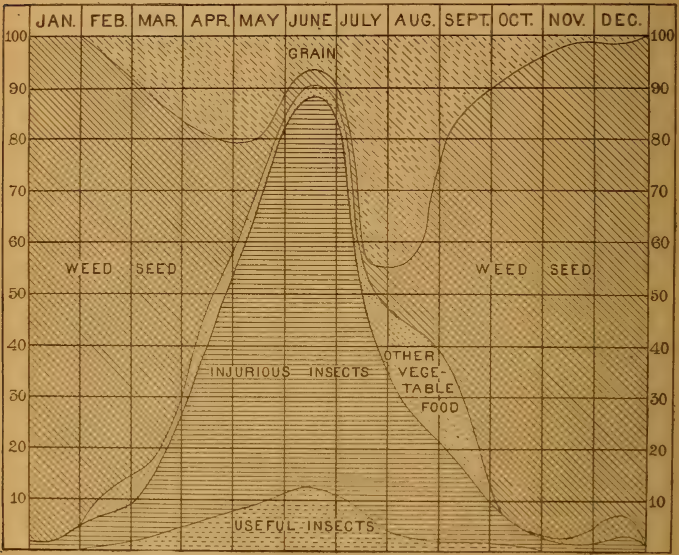

FIG. 5.—Diagram showing proportions of animal and vegetable food of red-winged blackbird in each month of the year. The relative amounts of the different kinds of food are shown by variously shaded areas. Thus, in June, useful insects are represented by the broken-lined area at the bottom of the column for that month, injurious insects by the horizontally shaded space, grain by the space shaded with diagonal broken lines, and the other elements of food in similar manner. The percentage of food (for example, of injurious insects), for a month, is not necessarily indicated by the summit of the curve, but by the space between the upper and lower curves. (The figures in the margins indicate percentages.)

The Biological Survey has examined 1,083 stomachs of the redwing, collected in every month of the year, and from thirty States, the District of Columbia, and Canada (see p. 74). The greater number of these stomachs were collected in the Northern States during and immediately before or after the breeding season. Most of those taken in the South were collected in Texas during the winter. These throw considerable light on the winter food, which does not apparently differ greatly from that eaten in the Northern States in the early spring and late fall. No stomachs were received from the rice-growing region during sowing and harvesting.

The food of the year was found to consist of 73.4 percent of vegetable matter and 26.6 percent of animal. The animal food begins with 1.4 percent in January and gradually increases to 88.2 percent in June, after which it regularly decreases to a fraction of 1 percent in November. With the exception of a few snails and crustaceans, it consists entirely of insects and their allies (spiders and myriapods), so that, roughly speaking, insects constitute one-fourth of the year's food. They consist principally of beetles, grasshoppers, and caterpillars, with a few wasps, ants, flies, bugs, and dragon-flies.

The beetles (Coleoptera) amount to a little more than 10 percent of the food, and the greater part of them are harmful insects. They belong to several families, but only one group is eaten extensively enough to be greatly distinguished above the others. This is the suborder of snout-beetles or weevils (Rhynchophora). These constitute 4.1 percent of the year's food, but in June amount to 22.4 percent of the food of the month. All the beetles of this group are injurious, some of them greatly so. Useful predaceous beetles (Carabidæ) are eaten to the extent of 2.5 percent of the food of the year, but are taken mostly in spring and early summer. Other beetles, belonging to several families, such as click-beetles (Elateridæ), leaf-beetles (Chrysomelidæ), May-beetles (Scarabæidæ), and a few others, amount altogether to 3.5 percent.

Grasshoppers (Orthoptera) are eaten practically in every month of the year, though none were found in the 11 stomachs taken in January. They constitute 4.7 percent of the whole food, and are exceeded by no other insects except beetles and caterpillars. The greatest number (amounting to 17 percent) are eaten in August, the 'grasshopper month.' As all species of grasshoppers are injurious, their destruction must be counted to the credit of the bird.

Caterpillars (larvæ of Lepidoptera) form 5.9 percent of the year's food. They are eaten to a slight extent in the winter months and in gradually increasing amounts up to May, when they form 20 percent of the food. Their consumption falls away to almost nothing in August, when grasshoppers are plentiful, and rises again in September, showing that grasshoppers are preferred, and for a short time replace the lepidopterous food. The same fact has been shown in the case of the Baltimore oriole, which leaves the trees in August and descends to the ground to eat grasshoppers.[1] While caterpillars are not all harmful, none of them as far as known are doing anything for the good of the farmer, so the redwings, in so far as they destroy these insects, are doing a beneficial work, and among those found in the stomachs were a number of the widely known and dreaded army worm (*Leucania unipuncta*). Miss Caroline G. Soule, in a letter from Brandon, Vt., quoted by Dr. C. M. Weed, says that the redwings, with other birds, do especially good work in destroying the pupæ of the forest-tent caterpillar, and later feed on the adult insects.[2]

Other insects, such as ants and wasps (Hymenoptera), bugs (Hemiptera), flies (Diptera), and dragon-flies (Odonata), with a few spiders and myriapods, make up the rest of the animal food, but none of them are eaten to such an extent as to render them of any striking economic importance. Ants, bugs, and flies are all more or less injurious or annoying insects, while wasps, dragon-flies, and spiders are probably for the most part somewhat useful. Dragon-flies are found about water, where the redwings also live, but they are too rapid in flight and too restless to be caught by anything less expert than a flycatcher, and it is probable that those eaten by redwings are picked up dead. Spiders are for the most part useful, but in a rather restricted way, and their destruction is not a great loss. Considered as a whole, the animal food of the redwings consists of insects, the most of which are positively harmful, while but few are decidedly beneficial.

The diagram on p. 38 shows in a striking manner the increase of the animal food in early summer—that is, in June. It is probable that the exhaustive labors of reproduction call for a more exclusively animal diet in May and June than does the strain of moulting in July and August. There seems to be no other theory by which to explain the decrease in the latter month, especially in view of the fact that these are the months when grasshoppers abound.

The vegetable food of the redwings consists mainly of seeds of grasses and weeds, the different kinds of grain being merely larger or more important grasses. Some of these plants, like wild rice (*Zizania*), have no economic importance; but many others, such as the cultivated grains, are of value, and their destruction is a positive loss; while still others, like ragweed (*Ambrosia*), are noxious weeds, the destruction of which is a benefit to the farmer. The following table shows all the vegetable substances found, with the number of stomachs in which each occurred:

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[1] Yearbook Dept. of Agriculture for 1895, p. 429.

[2] Bull. 64, N. H. Agr. Coll. Expt. Sta., May, 1900.

Vegetable substances found in stomachs of red-winged blackbirds.

	Stomachs.
Grain:	
Oats	190
Corn	117
Wheat	68
Barley	2
Forage:	
Clover (*Trifolium*)	4
Sorghum (*Sorghum*)	5
Timothy (*Phleum*)	7
Weeds:	
Panic-grass (*Panicum*)	168
Joint-grass (*Paspalum*)	21
Barngrass (*Chætochloa*)	271
Wild rice (*Zizania*)	24
Amaranth (*Amaranthus*)	4
Ragweed (*Ambrosia*)	189
Pigweed (*Chenopodium*)	4
Sunflower (*Helianthus*)	13
Gromwell (*Lithospermum*)	1
Plantain (*Plantago*)	1
Weeds—Continued.	
Smartweed (*Polygonum*)	200
Sorrel (*Rumex*)	64
Chickweed (*Alsine*)	9
Unidentified	168
Fruits:	
Blackberry (*Rubus*)	7
Blueberry (*Vaccinium*)	2
Gooseberry (*Ribes*)	1
Strawberry (*Fragaria*)	1
Indian currant (*Symphoricarpos*)	1
Hackberry (*Celtis occidentalis*)	1
Unidentified	14
Miscellaneous:	
Bayberry (*Myrica cerifera*)	2
Beechnuts (*Fagus*)	1
Pine seed (*Pinus*)	10
Sedge (*Carex*)	1
Bulb or tuber	4
Rubbish	54

In the list the chief interest, of course, centers about the grain. Of the four kinds eaten, oats are evidently the favorite, for they were found in 190 stomachs and amount to 6.3 percent of the year's food. April shows a little less than 6 percent for the month, undoubtedly collected from newly sown fields. In June they fall to less than 2 percent, in July rise to 22.6, increase somewhat in August, fall to 4.2 in September, and disappear entirely before the end of October. A few were found in December, but they do not appear in the other winter months. The oats eaten in July were probably taken from standing or newly cut grain, as perhaps were some of those eaten in August; but most of the oats in the United States are cut before the end of July, so that the greater part of those that were taken after this month must have been gleaned from the stubble or pilfered from the shock. Wheat first appears in March to the amount of 1.5 percent, but does not become an important item of food until July, when it rises abruptly to 13.1 percent. As July is the harvest month for wheat in most parts of this country it is reasonably certain that this grain is taken from the standing crop or gathered from the field after the reaper has done its work. August and September show 6.2 and 1.6 percent, respectively, all of which must have been scattered grain except where it could be stolen from the shock. The total amount of wheat for the year is only 2.2 percent. Corn is eaten to the extent of 2.6 percent in February, but the amount increases to 9.2 percent in March, after which it decreases to 3.0 percent in June. It rises through July and August to 7.5 percent in September, but falls off rapidly after September and is unimportant during the remainder of the year. The average for the year is 4.6 percent.

Grain collectively amounts to 13.9 percent of the food of the year, and its distribution as shown above leads to the conclusion that at least half of it is waste. Oats alone show an increased consumption in May, the month of sowing. July and August are the months of maximum consumption. All that is eaten after August, except corn, must be gathered from the stubble, unless the grain is left shocked in the field; and even in that case it is difficult to understand how the birds can do any serious damage if the shocks are properly put up and are not allowed to remain out an unreasonable time.

In order to gain a more thorough understanding of the grain-eating propensities of the redwings, a special study was made of the food for the five months from May to September, inclusive. Forty-six percent of the stomachs taken in May contained grain, and only 11 percent of those taken in June. The ratio then rises in July, and culminates at 72 percent in August, after which it decreases rapidly. The average for the five months is 46 percent; that is, in every 100 birds taken 46 had eaten grain. The grain-eating record, as exhibited by the bulk of the grain food, is quite different. Grain constitutes about 20 percent of the food by bulk in May and less than 6 percent in June, but rises to a maximum of nearly 43 percent in July and falls off slightly in August, after which it rapidly decreases and disappears. The average consumption for the five months is 24 percent of the whole food. Again, if the two months of July and August are considered alone, it will be found that although 68 of every 100 birds have eaten grain, this item constitutes only 41 percent of the food for the two months.

Still further restricting the study to birds taken in the Mississippi Valley, in the same five months, May to September, the percentage of grain shows an important increase. During these months 173 birds were collected in the States of Indiana, Illinois, Wisconsin, Minnesota, North Dakota, South Dakota, Iowa, Nebraska, and Kansas. The number, though small, is sufficient to serve at least as a clue to the food during this period. Grain was eaten by 60 percent of the birds collected in May, by 46 percent of those taken in June, by 80 percent of those taken in July, by 81 percent of those taken in August, and by 45 percent of those taken in September. Of the food of those taken in May, 27 percent was grain of various kinds; in June, 23 percent; in July, 51 percent; in August, 45 percent, and in September, 24 percent; an average of 34 percent of grain for the five months. As these are the ones in which nearly all of the grain is eaten, and as more than half of it is eaten in July and August, the above exhibit apparently shows the worst that the redwings do. Of the 1,083 stomachs examined, only 19 were filled with grain alone, while 217 were entirely filled with the seeds of weeds or useless plants. The total grain consumed, as given above, is less than that eaten by the crow blackbird (45 percent), the jay (19 percent), or the cowbird (17 percent). In view of the fact that the redwing has been under the ban in many States and in some still remains so, this result is rather surprising. It renders more impressive the fact that the damage is due to overwhelming numbers in that part of the country from which the complaints have come, and not the amount of grain eaten by the individual bird. The unequaled facilities for breeding afforded by that region have in many instances given rise to such immense flocks in a restricted area that, while each bird eats but a trifle, the total is tremendous.

Weed-seed is apparently the favorite food of the redwings, since the total amount of grass and weeds is 54.6 percent, more than half of the year's food, and more than four times the total grain consumption. These seeds are the principal article of diet of the birds in the Northern States in the early spring and late fall, and the stomachs received from the South during the winter are filled with them almost exclusively. They amount to more than 3 percent in June, the month of minimum consumption, and constitute a very appreciable percentage even during the months when grain is most abundant. The great bulk consists of the four well-known genera of noxious weeds, *Chætochloa* (barn-grass or foxtail), *Ambrosia* (ragweed), *Panicum* (panic-grass), and *Polygonum* (smartweed and knotweed). The others were found in from 1 to 64 stomachs each, and while not all are as much of a nuisance to clean cultivation as the four named, none have any useful function in agriculture. Fruit forms so insignificant a proportion of the redwing's food that it is hardly worth considering. Blackberries or raspberries were identified by their seeds in 7 stomachs, but only a few were found in each, and the percentage is trifling. The other species taken also appear in few stomachs and in small quantities.

The miscellaneous list contains a collection of makeshifts upon which the bird falls in case of necessity, the most curious of which, perhaps, is the seed of the pine tree. The birds from whose stomachs these were obtained were shot in the very act of picking the seeds from the cones in the top of the tree, a strange employment for an inhabitant of a marsh, but Dr. Coues notes the breeding of this bird near pine trees at a distance from any marsh.[1]

SUMMARY.

In summing up the economic status of the redwing the principal point to attract attention is the small percentage of grain in the year's food, seemingly so much at variance with the complaints of the bird's destructive habits. Judged by the contents of its stomach alone, the redwing is most decidedly a useful bird. The service rendered by the destruction of noxious insects and weed seeds far outweighs the damage due to its consumption of grain. The destruction that it sometimes causes must be attributed entirely to its too great abundance in some localities.

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[1] Birds of the Northwest, p. 187, 1874.

The following table shows the various elements of its food for each month:

Food of the red-winged blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 11; February, 48; March, 84; April, 104; May, 75; June, 158; July, 141; August, 151; September, 56; October, 91; November, 82; December, 82; total, 1,083.]

Food.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Predaceous beetl's	......	0.2	3.1	2.7	6.5	6.5	6.5	1.9	1.5	0.3	0.1	0.4	2.5
Snout-beetles	......	1.3	0.8	6.4	7.2	22.4	7.8	2.5	0.2	0.4	[1]Tr.	0.7	4.1
Other beetles	0.1	2.2	1.2	7.8	11.2	13.4	3.9	1.8	0.1	0.8	[1]Tr.	0.2	3.5
Caterpillars	0.1	2.1	8.2	8.2	20.1	16.4	4.3	0.9	9.5	0.3	[1]Tr.	0.3	5.9
Grasshoppers	......	0.2	0.2	4.6	3.3	12.7	13.4	17.0	4.1	1.1	[1]Tr.	[1]Tr.	4.7
Other insects	1.2	0.2	0.7	6.0	16.3	9.0	9.8	2.4	1.0	1.6	0.1	0.6	4.1
Spiders and myriapods	......	0.3	0.5	3.2	2.0	5.8	2.0	0.4	[1]Tr.	0.2	0.1	1.4	1.3
Other animal food	......	......	0.7	1.5	1.4	2.0	0.2	0.1	0.1	......	......	......	0.5
Total animal food	1.4	6.5	15.4	40.4	68.0	88.2	47.9	27.0	16.5	4.7	0.3	3.6	26.6
VEGETABLE.													
Fruit	......	2.0	1.2	0.6	......	0.5	2.1	0.6	......	......	[1]Tr.	......	0.6
Corn	......	2.6	9.2	7.8	5.1	3.0	4.2	5.7	7.5	6.9	1.4	1.3	4.6
Oats	......	......	......	5.9	13.5	1.4	22.6	27.3	4.2	0.3	......	0.2	6.3
Wheat	......	......	1.5	2.6	0.7	0.9	13.1	6.2	1.6	......	0.1	......	2.2
Other grain	......	0.8	1.2	2.3	0.4	0.4	2.7	1.8	......	......	......	......	0.8
Weed seeds	98.6	85.3	70.3	35.7	10.2	3.6	4.5	15.5	55.7	88.0	97.0	91.2	54.6
Other vegetable food	......	2.8	1.2	4.7	2.2	1.9	2.9	15.9	14.5	0.1	1.2	3.7	4.3
Total vegetable food	98.6	93.5	84.6	59.6	32.1	11.7	52.1	73.0	83.5	95.3	99.7	96.4	73.4

[1] Tr. = trace.

CALIFORNIA RED-WINGED BLACKBIRD.

(*Agelaius gubernator californicus.*)

The California red-winged blackbird is confined to the Pacific coast region west of the Cascades and the Sierra Nevada, and ranges from Washington to Lower California. The stomachs upon which this investigation is based, 61 in all, were collected in California at different times of the year, but none in February, May, or August (see p. 74). Although this number is entirely too small to give data that can be considered final, it is thought best to publish those obtained, as they will give some insight into the character of the food.

Of the total food, only 1.6 percent is animal matter, and the remainder, 98.4 percent, is mostly grain. The animal food consists of beetles, ants, grasshoppers, bugs, caterpillars, and a few spiders—mostly harmful, but so few in number that they are economically insignificant. Of the 98.4 percent of vegetable food, 85.5 percent consists of grain. This is made up of wheat, 28.9 percent; oats, 52.3 percent; and barley, 4.3 percent. Corn was not found. It is probable that this record would be somewhat modified by an examination of a larger series of stomachs representing every month of the year, but it must be remembered that one of the missing months is February, a month when birds feed to a great extent upon vegetable food, and another is August, which is a harvest month. The other vegetable food (12.9 percent) consists mostly of the seeds of noxious weeds.

Further field observation of the habits of this species is needed, but it is probable that the bird does great damage in places where it is abundant, especially in grain-growing sections. In view of the very large percentage of grain in the stomachs, and the fact that grain forms more than half the food in every month, it does not seem probable that the bird is able to supply its wants from the waste grain of the fields and corrals. Even if 50 percent were so obtained, a large percentage, more than 40 percent, of the total food still remains to the discredit of the species. Further investigation is necessary before final conclusions can be drawn, but it hardly seems probable that it can show the California redwing in any other light than that of a source of danger to grain.

THE RUSTY BLACKBIRD.

(*Scolécophagus carolinus.*)

One of the most familiar sights to the New England schoolboy, and one which assures him that spring is really at hand, is a tree full of blackbirds, all facing the same way and each one singing at the top of its voice. These are rusty blackbirds, or rusty grackles, which, on their spring journey to the north, have a way of beguiling the tedium of their long flight by stopping and giving free concerts. Every farmhouse by the wayside will have its visitors, and every boy who hears them is eager to tell his mates that he has seen the first flock of blackbirds. They breed in the Maritime Provinces of Canada, the northern parts of New England, New York, and Minnesota and northwestward nearly to the mouth of the Mackenzie River and Kotzebue Sound, Alaska; and spend the winter in the Southern States as far west as Texas and as far north as southern Illinois. In their migrations they are seen in immense numbers, especially in the Mississippi Valley.

The great majority of these birds nest so far north that they are beyond the limits of cultivation, and consequently have no economic interest during the breeding months. But as soon as the season of reproduction is over they begin to assemble and move southward, and it is evident that such vast flocks as they form might prove a serious menace to any crop on which they chose to prey. Reports, however, have not implicated them to any great degree in the devastation of grainfields, and it seems to be their habit to feed about swamps and in roads and stock yards. That they have a decided taste for foraging in wet ground or about water is shown by the contents of their stomachs, which included aquatic beetles of many species, with larvæ of ephemeridæ, caddice-fly cases, a few dragon-flies, small snails and other mollusks, salamanders, and small fishes.

The food of rusty blackbirds does not seem to have received much attention, but a few ornithologists have given it brief consideration.

Mr. C. J. Maynard reports that he has never found anything in their stomachs except insects and small mollusks.[1]

Col. N. S. Goss says:

> They are largely omnivorous in their food habits, preferring the various forms of insect life, snails, etc., that abound in the aquatic grasses; but during the winter months, when forced to feed largely upon grains and seeds, they frequent the cattle yards and corn fields, and further south forage off the rice plantations.[2]

Dr. Warren says:

> The food of this species consists largely of beetles, grasshoppers, snails and earthworms. They feed to a considerable extent on the seeds of various plants; different kinds of small berries are added to their *menu;* the scattered grains of wheat, rye or other cereals, which are to be found in the fields and meadows, are likewise eaten. When in cornfields they sometimes perch on the shocks and pick from the ears a few grains, the damage, however, which they do in this way is of but little importance.[3]

The investigation of the food of the rusty blackbird made by the Biological Survey is based on 132 stomachs, obtained from 16 States, the District of Columbia, and Canada (see p. 74). These stomachs represent every month of the year except June and July, when the birds are on their breeding range away from well-settled portions of the country. It is to be regretted that none of the months except March, April, October, and November are fairly represented. Few stomachs were obtained in the other months, January having but one to its credit.

The stomachs contained a larger proportion of animal matter (53 percent) than those of any other species of American blackbirds except the bobolink. This is the more remarkable in view of the fact that none were taken in the two breeding months of June and July, when in all probability the food consists almost exclusively of animal matter.

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[1] Birds Eastern N. A., p. 147, 1881.

[2] Hist. Birds of Kansas, p. 408, 1891.

[3] Birds of Pa., revised ed., p. 219, 1890.

While the birds are decidedly terrestrial in their feeding habits, they do not eat many predaceous ground-beetles (Carabidæ), the total consumption of these insects amounting to only 1.7 percent of the whole food. Scarabæids, the May-beetle family, form 2 percent, and in April 11.7 percent. Various other families of beetles aggregate 10.1 percent, largely aquatic beetles and their larvæ, which, so far as known, do not have any great economic importance. A few of the destructive snout-beetles (Rhynchophora) are also included, as well as some chrysomelids and others.

Caterpillars constitute 2.5 percent and do not form any very striking percentage at any time, except, perhaps, in May, when they amount to 11.7 percent. Grasshoppers nearly equal beetles in the extent to which they are eaten, and exceed every other order of insects, although none appeared in the stomachs taken in January, March, May, and December, and in February but a trace. In August, as usual, they reach the maximum, 44.3 percent, only a trifle higher, however, than the October record. The average for the year is 12 percent. Various orders of insects, such as ants, a few bugs, and also a few flies, with such aquatic species as dragon-flies, caddice-flies, and ephemerids were eaten in all the months except January, in which only one stomach was taken. They aggregate 13.7 percent of the whole food, but owing to the number of forms no one amounts to a noteworthy percentage, and many of them are of little economic importance. Spiders and myriapods (thousand-legs) are eaten to the extent of 4 percent and amount to 23 percent in August. Other small animals, such as crustaceans, snails, salamanders, and small fish, were found in the stomachs for nearly every month, and amount to 7 percent of the food of the year, but none of them are important from an economic point of view.

The vegetable food consists of grain, weed seed, and various miscellaneous substances, none of which amounts to any great percentage. The latter consist chiefly of a very small amount of fruit, a little mast, and a number of unidentifiable substances, probably picked up about water or in swamps. Of grain, corn is the favorite and amounts to 17.6 percent of the year's food. It constitutes 87 percent of the contents of the single stomach taken in January, but this record can not be used as a criterion, for with this exception the maximum percentage is 26.5 (average of 15 stomachs taken in November), while the stomachs collected in May, August, and September show not a trace of corn. The fact that corn constitutes respectively only 5 and 4 percent of the contents of the stomachs taken in December and February is additional evidence that the January percentage is exceptional. Wheat and oats collectively amount to only 6.8 percent of the year's food. Oats are apparently preferred and in March constitute 15.4 percent of the month's food. These March stomachs came from the Southern States, so it is probable that the grain was picked up on newly sown fields. Neither wheat nor oats were found in the stomachs taken in August. Grain collectively amounts to 24.4 percent of the whole food, but from its distribution through the year does not appear to have been taken from the harvest fields. It is probable that some of it was gathered from newly sown fields, but the greater part was undoubtedly stolen from corncribs or picked up in roads and stock yards as waste grain.

Weed seed is not so important an item of food with the rusty blackbirds as it is with the redwings, since with the former it amounts to only 6 percent of the year's food, and contrary to observations on most seed-eating birds, the greater portion of it is apparently eaten in the insect season. Only 1 percent was found in the stomach taken in January, but the amount increases irregularly up to a maximum of 23.3 percent in May. Of June and July we know nothing, but in August, the month in which the redwing begins to increase its seed diet, there is not a single trace of weed seed in the food of the rusty blackbirds. It constitutes 6.6 percent in September, a trifle in October, and 15 percent in November and is entirely absent in the 3 stomachs taken in December. This erratic distribution evidently indicates that weed seed is not sought after, but is simply taken when nothing better is at hand. Miscellaneous items of vegetable food amount to 16.6 percent of the food of the year. Fruit was found in a few stomachs, but does not appear to any important extent. Only three kinds were determined, but several stomachs contained pulp or skin that could not be identified. Several buffalo berries (*Shepherdia argentea*) were found in one stomach, hackberries (*Celtis occidentalis*) in another, and seeds of blackberries or raspberries (*Rubus*) in two or three others. Mast was found in a few stomachs, but the greater part of the miscellaneous food was indeterminable. The birds are evidently great scavengers, and so gather much food that is scarcely susceptible of classification.

SUMMARY.

While this record of the food of the rusty blackbird is somewhat fragmentary it still gives a very good idea of the bird's general diet. One important conclusion that can be drawn is that animal food is preferred, vegetable food serving as a makeshift. It is nearly certain that in June and July, when the birds are engaged in the exhausting function of reproduction, the diet must be almost exclusively animal. If those months were represented in this investigation, the relative proportion of the two classes of food would be much changed, and animal food would take a higher rank. The vegetable food is of little consequence, as the birds show no decided predilection for any particular kind, but eat whatever is at hand when animal food can not be obtained. Grain is not eaten to any great extent at harvest time, and the other items do not seem to have any special relation to the season in which they are eaten. While considerable animal food beside insects is eaten, on the other hand a considerable quantity of harmful insects is destroyed and very few useful ones are taken. As rusty blackbirds do not inhabit farms, their economic relations can not be said to be very important; but while not preying directly upon noxious insects or weeds which interfere with the cultivation of crops, it is yet possible that they incidentally do considerable good by eating insects. Although their foraging is done mostly in pastures and swamps, yet the insects which they devour count just so much from the sum total, and in the long run the destruction of noxious species is, perhaps, nearly as great a good to the farmer as though they were taken directly from his cultivated fields.

Grasshoppers and many scarabæid beetles are nuisances, and their destruction is a benefit to agriculture, no matter where they may be found. The same may be said of caterpillars and many other insects, which, though now feeding on useless plants of the marsh or thicket, are liable at any time, through an unusual increase in numbers or a change in environment, to turn their attention to some crop and become a veritable pest. On the other hand, aquatic beetles and small crustaceans, which form a considerable percentage of the diet of the rusty grackles, are to a great extent carnivorous in their habits, and it is difficult to see in what way they can ever become of any great economic importance.

The following table shows the percentages of the principal elements of the food for each month:

Food of the rusty blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 1; February, 6; March, 17; April, 49; May, 7; June, none collected; July, none collected; August, 4; September, 5; October, 25; November, 15; December, 3; total, 132.]

Food.	January.	February.	March.	April.	May.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Predaceous beetles	......	......	4.5	6.1	......	1.8	1.6	2.2	0.3	......	1.7
May-beetle family	......	2.5	......	11.7	......	0.7	......	3.2	2.2	......	2.0
Other beetles	......	37.3	13.4	13.7	25.9	1.0	7.0	1.6	1.3	......	10.1
Caterpillars	......	4.0	1.5	5.0	11.7	......	......	2.3	0.4	......	2.5
Grasshoppers	......	0.2	......	9.3	......	44.3	18.6	44.2	3.9	......	12.0
Other insects	......	25.8	13.9	15.5	20.0	26.0	16,0	4.5	13.2	1.7	13.7
Spiders and myriapods	......	0.9	3.8	4.9	4.1	23.0	......	2.7	0.3	......	4.0
Other animal food	......	1.5	7.7	2.5	1.3	......	16.2	5.1	5.9	30.0	7.0
Total animal food	......	72.2	44.8	68.7	63.0	96.8	59.4	65.8	27.5	31.7	53.0
VEGETABLE.											
Corn	87.0	4.0	23.8	20.8	......	......	......	9.0	26.5	5.0	17.6
Other grain	12.0	......	15.4	3.7	12.1	......	13.4	7.3	4.5	......	6.8
Weed seed	1.0	0.3	8.4	4.4	23.3	......	6.6	0.8	15.0	......	6.0
Other vegetable food	......	23.5	7.6	2.4	1.6	3.2	20.6	17.1	26.5	63.3	16.6
Total vegetable food	100.0	27.8	55.2	31.3	37.0	3.2	40.6	34.2	72.5	68.3	47.0

BREWER'S BLACKBIRD.

(*Scolecophagus cyanocephalus.*)

Brewer's blackbird breeds from Manitoba and the eastern edge of the Great Plains south to northern New Mexico and westward to the Pacific, and spends the winter in the southern part of this region and in Mexico. The economic status of the species has as yet hardly become well defined, but some complaints have been received from the grain-growing sections, and it may possibly be a pest where it exists in any great numbers. The bird is eminently gregarious most of the year, though less so at breeding time. Like the cowbird, it is an industrious gleaner in pastures, barnyards, and roads, and even invades the streets of towns for the purpose of gathering scattered grain and other forage.

But little testimony is available as to the food of Brewer's blackbird, but Goss says that the members of this species are "social, gregarious birds, breeding in small colonies, and foraging together over the cultivated fields, pastures and plains; indiscriminate eaters of insect life, seeds, etc., and * * * regular visitants of the slaughterhouses."[1] In the investigation by the Biological Survey 146 stomachs were examined, collected from six States and representing every month except April (see p. 75).[2] The first analysis of the food shows that animal matter forms 31.8 percent and vegetable matter 68.2 percent. The animal food consists almost wholly of insects, the only exceptions being a few spiders and snails. The insects are mostly beetles, ants, wasps, and grasshoppers, with a few caterpillars, flies, and bugs. Beetles amount to 7.8 percent of the food of the year. The only group which appears at all prominently is that of the snout-beetles, or Rhynchophora, which in May constitute 29 percent of the food. In the other months they are not found so often, and the average for the year is only 3.4 percent. Predaceous beetles (Carabidæ) are eaten to the amount of 1.7 percent, and are not conspicuous in any month. Hymenoptera constitute 14.8 percent of the food for August, but do not appear very prominently in the other months, and average but 2.5 percent for the year. They consist for the most part of wasps and ants, with a few of the smaller parasitic species.

Grasshoppers are the favorite insect diet, constituting more than half of the total animal food (16.1 percent). Only a trace appears in the February stomachs, but in March the amount increases to 20.5 percent, and except in July does not fall below this figure until October. In August, which as usual is the month of greatest consumption, grasshoppers constitute 47.5 percent—nearly half of all the food.

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[1] Hist. Birds of Kansas, p. 409, 1891.

[2] One stomach was taken in April, but as its contents were quite unlike the average of those collected in March and May, it has been discarded until more can be obtained for the same month.

In July the percentage falls to 8.2, apparently because at that time the grain harvest is at hand and the birds eat freely of oats, wheat, etc. The miscellaneous list is made up of a few flies, bugs, and caterpillars, the latter such as might be expected in the stomach of a bird of the habits of the species under consideration, though the number really found is surprisingly small. One stomach taken in California in March contained 90 per cent of caterpillars, and a few other stomachs contained them in smaller amounts; but they do not constitute an important percentage of any month. Mr. J. F. Illingsworth, of Ontario, Cal., says that he has never failed to find from one to five worms [caterpillers] in each stomach that he has examined, which indicates that under some circumstances they do eat these insects extensively.

The vegetable food of Brewer's blackbird is preeminently grain, which amounts to 60.3 percent of the total food of the year, while all other vegetable food aggregates only 7.9 percent. Oats, corn, wheat, and a little barley are eaten, and of these oats are the most important, amounting to nearly three-fourths of the total quantity and being eaten in every month of the year.[1] Corn stands next to oats, but far below in quantity; wheat follows next in order, and barley comes last, the latter having been found in only two stomachs.

So important an element is grain that it constitutes more than 50 percent of the food in each of eight months, and in May, the month of least consumption, still amounts to 21 percent of the whole food. While much of this may be waste grain, it can hardly be probable that all of it is picked up in highways and byways. In July it amounts to nearly 72 percent of the food, and there can be no doubt that much of this is gathered from ripening fields. Other vegetable food consists for the most part of weed seed, but the small amount differs remarkably from the quantities eaten by the redwing and cowbird, which are great weed destroyers at all times, and especially in winter. Brewer's blackbird eats grain in every month, and in winter subsists upon it almost entirely. Mr. Walter K. Fisher, writing from Stockton, Cal., reports it as feeding on newly sown wheat that had not been harrowed in and eating nearly all that had been thus left exposed. He describes the birds as visiting the fields in immense flocks, which, at a distance, look like smoke rising from the ground, and says that stomachs of birds taken on such fields were found to be full of wheat.

SUMMARY.

In summing up the results of this investigation it must be acknowledged that the stomachs examined are too few, and are not distributed widely enough geographically, to justify a final economic classification of the bird. Nevertheless some very salient points seem to have been brought out, viz: (1) No order of insects is especially sought except grasshoppers (Orthoptera), which constitute more than half of the animal food; (2) more than 88 percent of the vegetable food consists of grain, which is eaten freely at all seasons, even when insects are abundant; and (3) seeds of harmful weeds are eaten sparingly.

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[1] The greatest quantities were found in stomachs taken in January at Escondido, Cal.

In spite of this apparently discreditable record complaints of this blackbird have been fewer than of several other species, while, on the other hand, some observers speak highly of it. Prof. A. J. Cook, of Claremont, Cal., says that he considers it one of the most valuable species in that State. So far as shown by field observation and stomach examination it does not attack fruit, and this is an important point in a California bird. Mr. J. F. Illingsworth, of Ontario, Cal., in a paper read before the Pomona Farmers' Club,[1] speaks of the species as a beneficial one that should be protected. It is possible that the large amount of grain found in the stomachs consists principally of gleanings from the harvested fields, corrals, and other places; but even if this be true, a bird with such a pronounced taste for grain would, if abundant, always be a menace to ripening crops. The following tabular statement shows the principal elements of the food:

Food of Brewer's blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 7; February, 7; March, 4; April, no stomachs collected, May, 7; June, 10; July, 10; August, 24; September, 38; October, 14; November, 10; December, 15. Total, 146.]

Food.	January.	February.	March.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Predaceous beetles	5.0	0.6	......	0.3	3.3	......	3.9	0.9	......	3.7	1.1	1.7
Snout-beetles......	......	0.4	2.0	29.0	4.5	0.5	[1]Tr.	0.3	......	0.2	0.9	3.4
Other beetles......	3.4	3.0	0.3	3.0	13.7	3.8	0.6	0.3	0.4	0.9	0.3	2.7
Wasps, ants, etc....	......	0.1	0.5	0.8	3.2	0.4	14.8	0.6	7.2	......	0.1	2.5
Grasshoppers......	......	0.2	20.5	33.3	26.8	8.2	47.5	33.1	0.6	......	7.1	16.1
Other insects......	1.0	4.0	22.5	9.0	10.6	......	0.6	1.1	0.8	8.4	0.9	5.4
Total animal food......	9.4	8.3	45.8	75.4	62.1	12.9	67.4	36.3	9.0	13.2	10.4	31.8
VEGETABLE.												
Grain.............	90.6	77.1	53.2	21.0	32.7	71.9	29.8	48.1	85.4	71.8	81.7	60.3
Other vegetable food............	......	14.6	1.0	3.6	5.2	15.2	2.8	15.6	5.6	15.0	7.9	7.9
Total vegetable food...	90.6	91.7	54.2	24.6	37.9	87.1	32.6	63.7	91.0	86.8	89.6	68.2

[1] Tr.= trace.

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[1] Ontario Observer, June 3, 1899.

THE CROW BLACKBIRD.[1]

(*Quiscalus quiscula.*)

Throughout the Eastern States and Mississippi Valley the grackle, or crow blackbird, is one of the most familiar and conspicuous birds. It appears in spring and early summer about farmhouses and villages, where it finds its favorite nesting places. Five different kinds occur within our borders, but the present paper is concerned only with the common purple grackle (*Quiscalus quiscula*) and its two subspecies, the bronzed grackle (*Quiscalus q. æneus*) and the Florida grackle (*Quiscalus q. aglæus*). The purple grackle is abundant in the region east of the Alleghenies as far north as New York, and is found sparingly in New England. The Florida grackle is distributed over the region extending from the coast of South Carolina southward into the peninsula of Florida and westward to Louisiana. The bronzed grackle occupies the Mississippi Valley and Great Plains as far west as the Rocky Mountains, ranges northward to Great Slave Lake and southern Newfoundland, and east to the coast of southern New England.

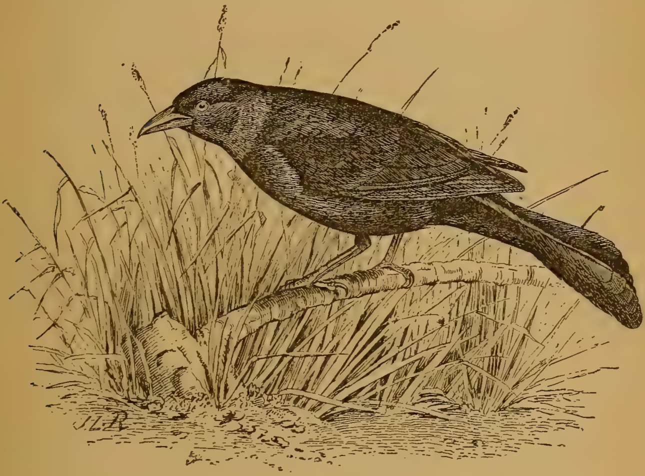

FIG. 6.—Crow Blackbird.

In Canada and the Northern United States the crow blackbird is only a summer resident, but in the Southern States it is present throughout the year, and in winter its numbers are increased by millions of migrants from the North, which find here a congenial winter home. It does not occur south of the Gulf States, but stragglers have been found during the cold months as far north as Illinois and even Minnesota.

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[1] Revised and republished from the Yearbook of the Department of Agriculture for 1894, pp. 233–248, with the addition of new material.

At the first approach of spring the crow blackbirds begin to move northward, closely following the retreat of winter. During the summer months they cover the whole of the United States east of the Rocky Mountains, except New England, though they are most plentifully distributed over the great grain-raising States of the Northwest. In New England crow blackbirds are of local occurrence. They are tolerably abundant in Connecticut, but in the more northern States breed only in certain favored localities, and are entirely absent from large areas.

In the Northern United States the southward movement begins about the end of September, although the habit of collecting in flocks immediately after the breeding season causes the birds to disappear from many localities during the month of August. Their stay in the northern part of the country is thus limited to the six warmest months of the year; hence whatever they do that is either beneficial or injurious must be accomplished during that time. In the South, on the contrary, they are found throughout the year, and in largely increased numbers during the winter. Fortunately, however, the time of their greatest abundance is not the season of growing crops, so that the damage done is principally confined to the pilfering of grain left standing in the shock. It is probable, however, that at this season they feed largely on weed seeds, mast, and waste grain scattered in the field.

Crow blackbirds are gregarious, usually breeding in colonies and migrating in flocks. In fall, young and old collect in large assemblages, which in the Mississippi Valley often grow to enormous size. The redwing (*Agelaius phœniceus*), Brewer's blackbird (*Scolecophagus cyanocephalus*), and the rusty blackbird (*S. carolinus*) often associate with them. Moving southward, immense flocks cross the Red River Valley between Texas and Indian Territory. In September, 1886, Mr. George H. Ragsdale reported at Gainesville, on the Texas side of the river, "flocks of such size that the roar of their wings could be heard for a quarter of a mile," and that, according to a statement published in a local paper, one person had on hand 8,000 blackbirds which had been netted for the use of gun clubs. Mr. Ragsdale stated that at the same time the grass worm was destroying the crab-grass and purslane, and attributed the unusually large flocks of blackbirds to the fact that the early fall migrants, finding so many worms, had halted until the bulk of the birds drifted southward. About the first of October the worms and birds disappeared simultaneously.

Crow blackbirds are well known to the farmer as foragers about the barnyard and pigpen. When they arrive in spring, after their long journey from the South, they are apt to depend on the corncrib for some of their first meals; but when the plow begins its work they are on the alert, and follow it up and down the furrows, seizing every grub or other insect that may be turned up. Their industry in this respect is very noticeable, and if not disturbed or frightened in any way they often become so tame as scarcely to get out of the way of the team in their eager search for food. Very soon a nest is built, and in a short time four or more gaping mouths demand to be filled, and the parent birds must then work harder and go farther afield to provide for the increased number of stomachs. When the cherries and other early fruits ripen, the birds take a share for themselves thinking, no doubt, that they are fairly entitled to them for the good work they did earlier in the season. When the corn 'comes into the milk' they also take a portion.

In the selection of food the crow blackbird is almost omnivorous. Its partiality for corn, wheat, rice, oats, and other grain is well known, and is the cause of nearly all the complaints about its depredations. This diet is supplemented by various fruits, berries, nuts, seeds, and insects, the last in large proportion. But the character of the food varies materially with the season. During the fall and winter blackbirds subsist largely on seeds and grain, as spring approaches they become more insectivorous, in summer they take small fruits, and in September they attack the ripening corn; but at all seasons they probably select the food that is most easily obtained.

To this varied diet are due the conflicting statements respecting the useful or noxious habits of the species. When feeding on grain, the birds are usually in large flocks and their depredations are plainly visible. When breeding they are less gregarious, and the good work they do in the fields is scarcely noticed, although at this season the grubs and other insects devoured compensate in large measure for the grain taken at other times. As Mr. N. W. Wright, of Farmland, Ind., aptly says, "It is hard to tell on which side to place the crow blackbirds, for we can see the damage done, but not the benefits."

During the spring they destroy many noxious insects. Prof. D. E. Lantz states that at Manhattan, Kans., from the time of their arrival until August they feed almost entirely upon cutworms, and Prof. Herbert Osborne, writing from Ames, Iowa, reports that during the spring of 1883 he saw them destroy great numbers of May-beetles (*Lachnosterna fusca*), and found them feeding on them for several weeks. Grasshoppers, crickets, locusts, and other insects are also largely eaten. Mr. J. Percy Moore, of Philadelphia, Pa., wrote in 1885:

> During the recent visit of the 17-year cicada this species [the purple grackle] devoured immense numbers of pupæ and imagos. It also ate large numbers of the grubs of the June bug, which it generally obtained by searching in the furrows in newly plowed fields, and all stages of the Carolina and other grasshoppers, the common white butterfly (I saw one catch several of this species on the wing May 26, 1885), and other species not identified.

Mr. W. B. Hall, of Wakeham, Ohio, gives an interesting account of some young grackles which were kept in captivity. He says:

> I have captured the young and confined them in a cage in such manner that the old bird could not reach the mouth of the young. The food brought consisted largely of larvæ of *Coleopterous* and *Lepidopterous* insects, with an occasional beetle. If freshly plowed fields were in the vicinity the food consisted largely of the white grub and cutworm, a few tent caterpillars, one worm that I took to be a small *Attacus*, and beetles of the genera *Galerita*, *Cetonia*, *Lachnosterna*, and their kindred.

An estimate of the amount of food required to support a large flock of blackbirds has been made by Mr. H. H. Johnstin, of London, Ohio. During the autumn of 1894 he counted 1,100 blackbirds one morning as they left their roosting places for the feeding grounds, and estimated the birds which flew by at 50,000. Allowing 2 ounces as the quantity of food collected by each bird during the day, he arrived at the conclusion that 6,250 pounds, or more than 3 tons, of food was consumed by this army of blackbirds in a single day. Even if the number of birds in this case is not overestimated, the amount of food per bird is undoubtedly too great. The species of blackbirds to which these notes refer are not stated, but it is safe to assume that the flocks were made up of redwings (*Agelaius*) and crow blackbirds (*Quiscalus*). A full stomach of the crow blackbird, selected at random from specimens in the collection of the Biological Survey, was found to weigh 0.158 ounce, or 2.53 drams, while the contents of another stomach weighed only 0.116 ounce, or 1.85 drams. The average of two full stomachs of red-winged blackbirds was 0.049 ounce, or 0.78 dram, and the stomach contents of a third weighed only 0.021 ounce, or 0.33 dram. While of course these figures do not give the quantity of food a bird consumes in twenty-four hours, they show that the full stomach of a blackbird weighs comparatively little. In order to consume 1 ounce of food per day a crow blackbird must eat six or eight full meals, according to the kind of food, and the redwing three or four times as many. At this rate the amount consumed by the flock of 50,000 birds would be about a ton and a half per day. These figures are undoubtedly still too large, but they serve to give a slight hint of the quantity of grain a large flock could destroy.

The accusations against the crow blackbird, briefly stated, relate mainly to the destruction of grain, especially corn, soon after planting in the spring, and again in the autumn, when the corn is 'in the milk' and nearly ripe. In the Southern States rice is also destroyed by grackles. In some sections they are said to feed upon young grain in such quantities as seriously to injure the value of the crop, and for this reason they are poisoned in large numbers. A more effectual method is to prevent the birds from taking the seed by tarring the corn before it is planted. This is better, simpler, and cheaper than the wholesale destruction of the birds.

Mr. S. T. Kimball, of Ellington, Conn., says:

> As a rule, farmers here tar their corn, but last June I sowed some without tarring, and the result was that by the time it was out of the ground the blackbirds had attacked it. They worked all day, carrying their bills full—load after load—to a cemetery where there is quite a colony. They kept this up till the corn was entirely absorbed by the stalk, although I shot some five or six of them.

Mr. George K. Cherrie states that in Monona County, Iowa, during the spring of 1884, both the crow blackbird and the yellow-headed blackbird did considerable damage by pulling the corn just as it came through the ground, and were poisoned in great numbers by corn which had been soaked in water containing arsenic. Similar depredations are sometimes committed in the rice fields of the South.

According to Mr. W. C. Percy, jr., of Bayou Goula, La., the crow blackbirds destroy rice and corn at that place to a great extent, and would do so totally were not men stationed with guns. They eat it in planting time only.

In the autumn, when the corn begins to ripen, the fields are again visited by blackbirds in larger flocks than in the spring, and the birds renew their work of destruction. Mr. Daniel S. Wardsworth reports that in a field of 2 acres near Hartford, Conn., the grackle has been known to ruin from one-third to one-half of a crop of corn 'in the milk' or when ripe. A similar complaint was made by Mr. George H. Selover, of Lake City, Minn.

Mr. S. Powers, of Lawtey, Fla., writes that in the section where he lives corn is left on the stalk as long as possible, to escape the weevils, and the blackbirds eat the ends of many ears, sometimes one-third of their length.

Another accusation often made against the crow blackbird is that it destroys the eggs and young of other birds. A cursory examination of the statements of writers shows that very few are based on original observation; the majority are either repeated from the observations of others or are taken from published accounts of the bird's habits. It can not be doubted, from the statements which have been made, that these birds do occasionally destroy the eggs of the robin, bluebird, chipping sparrow, small flycatchers, and other species, and more rarely the young of the robin. But stomach examination offers little corroborative evidence. Of 2,346 stomachs, only 37 contained any trace of birds' eggs, and 1 contained the bones of a young bird. These were distributed as follows: In April, 9; May, 9; June, 7; July, 7; and August, 5. The greatest quantity of eggshell was found in May, aggregating forty-six one-hundredths of one percent of the stomach contents for that month. This certainly does not show that blackbirds are much given to robbing their neighbors. Further, the eggshells found in a number of stomachs were identified as those of domesticated fowls, and were probably obtained from compost heaps, where they had been thrown. Hence, it seems fair to infer that the grackle indulges its nest-robbing proclivities only occasionally, and that the prevalence of the habit has been considerably exaggerated.

The crow blackbird, by reason of its habits, numbers, and wide distribution over the eastern part of our country, is so conspicuous among the native birds that much valuable information concerning its food habits is contained in previous publications.

Wilson refers to it as a 'noted depredator' that 'is well known to every careful farmer of the Northern and Middle States,' and says:

> About the 20th of March the purple grakles visit Pennsylvania from the south, fly in loose flocks, frequent swamps and meadows, and follow in the furrows after the plough; their food at this season consisting of worms, grubs, and caterpillars, of which they destroy prodigious numbers, as if to recompense the husbandman beforehand for the havoc they intend to make among his crops of Indian corn. * * * The trees where these birds build are often at no great distance from the farm house, and overlook the plantations. From thence they issue, in all directions, and with as much confidence, to make their daily depredations among the surrounding fields, as if the whole were intended for their use alone. Their chief attention, however, is directed to the Indian corn in all its progressive stages. As soon as the infant blade of this grain begins to make its appearance above ground, the grakles hail the welcome signal with screams of peculiar satisfaction, and, without waiting for a formal invitation from the proprietor, descend on the fields and begin to pull up and regale themselves on the seed, scattering the green blades around. * * * About the beginning of August, when the young ears are in their milky state, they are attacked with redoubled eagerness by the grakles and redwings, in formidable and combined bodies. They descend like a blackening, sweeping tempest on the corn, dig off the external covering of twelve or fifteen coats of leaves, as dexterously as if done by the hand of man, and, having laid bare the ear, leave little behind to the farmer but the cobs, and shriveled skins, that contained their favorite fare. I have seen fields of corn of many acres, where more than one-half was thus ruined. Indeed the farmers in the immediate vicinity of the rivers Delaware and Schuylkill, generally allow one-fourth of this crop to the blackbirds, among whom our grakle comes in for his full share.
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> * * * As some consolation, however, to the industrious cultivator, I can assure him, that were I placed in his situation, I should hesitate whether to consider these birds most as friends or enemies, as they are particularly destructive to almost all the noxious worms, grubs, and caterpillars, that infest his fields, which, were they allowed to multiply unmolested, would soon consume nine-tenths of all the production of his labour, and desolate the country with the miseries of famine.[1]

Nuttall speaks of the bird's destructiveness in the cornfield in much the same terms, and adds:

> Up to the time of harvest, I have uniformly, on dissection, found their food to consist of these larvæ, caterpillars, moths, and beetles, of which they devour such numbers, that but for this providential economy, the whole crop of grain, in many places, would probably be destroyed by the time it began to germinate. In winter they collect the mast of the beech and oak for food, and may be seen assembled in large bodies in the woods for this purpose.[2]

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[1] Am. Ornith., Edinburgh ed., Vol. I, pp. 227–230, 1831.

[2] Manual of Ornith., Land Birds, pp. 195–196, 1832.

Mr. C. J. Maynard repeats the charges of depredations in the cornfield, but contends that their trait of robbing nests of other birds is by far the worst damage they do. He says:

> They will visit the homes of those species which build in accessible situations and deliberately remove the eggs or, what is more to be deplored, the helpless young and devour them in spite of the cries of the distracted parents who are powerless to prevent the outrage. * * * So frequently were these depredations committed upon the homes of the Robins and other birds, that built about my place this season, that there was scarcely an hour in the day during early summer when I could not hear the warning cries of the adult birds, followed by the harsh, scolding notes of the Crow Blackbird as he was vigorously attacked on all sides, but he seldom retreated without accomplishing his purpose. Such continuous slaughter must greatly thin the ranks of the birds that are thus robbed and it will be safe to say that the Purple Grackles destroy more birds than all the other predatory species combined. * * *
>
> In Florida * * * they also eat a variety of food. In early Winter large flocks may be seen on the tops of the palmettos, feeding on the fruit, and they also eat berries in their season. Later small flocks are found on the margin of streams, frequently wading into them in search of little mollusks, crabs, etc., and it is not rare to meet with one or two scattering individuals in the thick hummocks, overturning the leaves in order to find insects or small reptiles which they devour. I once saw one catch a lizard which was crawling over the fan-like frond of a palmetto, and fly with it to the ground. The reptile squirmed all the while in its frantic endeavors to escape, but the Blackbird held it firmly and, after beating it to death, removed the skin as adroitly as if accustomed to the operation, then swallowed the body.[1]

Dr. B. H. Warren says as a result of his investigations of the food of the crow blackbird:

> In the wake of the plowman, as he turns the crumbling earth, closely follow the argus-eyed Grackles, ever on the alert to seize the wriggling worm, the agile beetle, or the glistening grub, and the numerous *larvæ* thrown out as each furrow is turned. Certainly, at this season our sable acquaintances are engaged only in that which will prove of utility to the cultivator when his crops are growing. We repeatedly hear of how the blackbirds tear up and devour the young and growing corn. This, unquestionably, is sometimes the case, but I am confident that the destruction thus done is much exaggerated. I am aware that on more than one occasion I have seen the tender blades of corn lying on the ground where were actively at work Crow Blackbirds, a number of which were shot, and on a post-mortem dissection their stomachs revealed almost entirely insects. Some six years ago I was visiting a friend who had thirty-odd acres of corn (maize) planted. Quite a number of "blackies," as he styled them, were plying themselves with great activity about the growing cereal. We shot thirty-one of these birds feeding in the corn field. Of this number nineteen showed only *cut-worms* in their stomachs. The number of cut-worms in each, of course, varied, but as many as twenty-two were taken from one stomach. In seven some corn was found, in connection with a very large excess of insects, to wit: Beetles, earth-worms, and cut-worms. The remaining five showed chiefly beetles. * * *
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> Strawberries, blackberries and other fruits are fed upon, but to a very limited extent, by this species. The diet of the young birds, while under parental care, is almost exclusively insectivorous, consisting mainly of caterpillars and grubs.
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> It is a well-established fact that they are given to pillaging the eggs of other birds, especially the common Robin. Gentry, however, states that they destroy the young of birds, a fact, as yet, unobserved by the writer.[2]

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[1] Birds of Eastern N. A., pp. 149–150, 1881.

[2] Birds of Pa., revised ed., pp. 221–222, 1890.

Nearly 2,500 crow blackbird stomachs have been examined in the laboratory of the Biological Survey, of which 2,346 contained food; the remainder were empty. These stomachs were obtained from twenty-seven States, the District of Columbia, and Canada (see p. 75). Nebraska and Dakota are the most western States in which any were collected, and Florida and Texas the most southern. The stomachs were taken during every month in the year, but as the great body of the birds leaves the Northern States in October and does not return until March, but few stomachs could be procured in November, December, January, and February. Great pains were taken to secure a large number during the breeding months of May and June, with the result that a little more than half of the whole collection was obtained at this time. Observation has shown that the food of young birds often differs materially from that of the adults, and in order to test this point 456 nestlings were collected in May and June.

The food of the whole year, taking into account all the 2,346 stomachs, young and adult, comprised 30.3 percent animal, and 69.7 percent vegetable matter. The animal food was found to be composed of insects, spiders, myriapods, crayfish, earthworms, sowbugs, hair snakes, snails, fish, tree toads, salamanders (newts), lizards, snakes, birds' eggs, and mice.

Insect food constitutes 27 per cent of the entire food for the year, and is the most interesting part of the bird's diet from an economic point of view.

When it is examined month by month, the smallest quantity appears in February (less than 3 per cent of the whole food), but as only 8 stomachs were taken in this month the result can not be considered very reliable. In March it rises to one-sixth, and steadily increases till May, when it reaches its maximum of five-eighths of the whole; it then decreases to one-sixth in October, and appears to rise again in November, but the number of stomachs taken in that month is too small to warrant any general conclusions. The great number of insects eaten in May and June is due in part to the fact that the young are fed largely on this kind of food.

Analysis of the insect food presents many points of interest. Among the most important families of beetles are the scarabæids, of which the common June bug or May-beetle and the rose bug are familiar examples. These insects are eaten, either as beetles or grubs, in every month except January and November; in May they constitute more than one-fifth, and in June one-seventh of the entire food. The habit grackles have of following the plow to gather grubs is a matter of common observation which has been fully confirmed by stomach examinations. Many stomachs were found literally crammed with grubs, and in many more, where other food predominated, the hard jaws showed that grubs had formed a goodly portion of a previous meal.

The species most commonly found in the stomach belong to the well-known genus *Lachnosterna*, or common May-beetle, several species of dung-beetles belonging to the genera *Aphodius* and *Atænius*, and the wonderfully brilliant *Phanæus carnifex.* The last is one of the most conspicuously colored of all the beetles, being clad in green, purple, and gold, which shade to crimson with the changing light. Whether these splendid tints attract the birds' attention, whether there is some peculiarly agreeable flavor to recommend the insects as an article of diet, or whether the simple fact of availability from their great abundance impels the birds to eat them so freely is yet to be determined; but, from whatever cause, a majority of the stomachs of all the grackles taken in the Mississippi Valley during summer contained at least a trace and often the remains of several of these beetles.

Curculios, snout-beetles or weevils, are eaten in every month of the year, but, while they are taken in great numbers, the individuals are so small that the percentage of bulk does not rise as high as in the case of the scarabæids. The maximum is reached in June, when they constitute more than 5 percent of the total food, with a gradual decrease in the succeeding months. Insects of such small size could hardly be obtained except by diligent search, and their presence in so many stomachs (1,059), and also the large numbers in single stomachs (sometimes exceeding 40), warrants the conclusion that they are sought as choice articles of food. The species most often eaten are *Epicærus imbricatus*, *Phytonomus punctatus*, *Sitones hispidulus*, and more rarely *Sphenophorus zeæ* and other species of *Sphenophorus.* Of this last, commonly known as the corn weevil, 17 were found in one stomach and 14 in another.

Many other beetles were found in the stomachs, but, with one exception, in quantities too small to be of much economic interest. The Colorado potato beetle was not present, but several species belonging to the same family were identified. The one exception just referred to is that of the carabids or predaceous beetles. These valuable destroyers of noxious insects are eaten in every month of the year in varying quantities, but with less variability than most other insects. They constitute more than 7 percent of the food in January, attain a maximum of 13 percent in June, and end with one-half percent in December. From these figures it would seem that they are highly prized by blackbirds; but there are other facts that have a bearing on the case. Most carabid beetles are of fair size and easily seen, and many of them are quite large; moreover, they live on the ground and are much oftener seen running than flying. They are the first beetles observed in spring, and are usually abundant at all times when insects are to be found. Since blackbirds seek a great portion of their food on the ground it is apparent that these beetles must naturally fall in their way oftener than any others, and so are freely eaten, especially if other food be wanting. They may thus be eaten more from necessity than from choice. It does not, however, necessarily follow that birds are doing harm by eating insects that on account of their food habits are classed as useful. This point has been fully elucidated by other writers, notably by Prof. S. A. Forbes.[1]

Next in importance to beetles as an article of blackbird diet are the grasshoppers. For convenience, grasshoppers, locusts (green grasshoppers), and crickets are considered in the same category, but of the three the true grasshoppers were by far the most numerous in the stomachs, and are eaten in every month except January. They constitute less than 1 percent of the total February food, and the fact that they are found at all in this month indicates that the birds are keen hunters, for it would puzzle an entomologist to find grasshoppers in February in most of the Northern States. It is probable that some of those eaten in this and the succeeding month are dead insects left over from the previous year. The proportion of grasshoppers in the stomachs increases with each month up to August, when it attains a maximum of 23.4 percent of all the food. It is worthy of note that crickets, considered apart from grasshoppers, reach their maximum in June, when they form a little more than 5 percent of the monthly food.

After August the grasshopper diet falls off, but even in November it still constitutes 9 percent of the total for the month. The frequency with which these insects appear in the stomachs, the great numbers found in single stomachs (often more than 30), and the fact that they are fed largely to the young, all point to the conclusion that they are preferred as an article of food, and are eagerly sought at all times. The good that is done by their destruction can hardly be overestimated, particularly as many of the grasshoppers found in the stomach were females filled with eggs.

Caterpillars form another interesting element of this bird's food. They were found throughout the year, except in November, and average 2.3 percent in each month. In May a maximum of something more than 8 percent is reached, followed by a little less than 4 percent in June, and falling below this through the remainder of the year. The famous army worm (*Leucania unipuncta*) was identified in about half a dozen stomachs.

Most persons who have picked and eaten berries from the bushes have had the disagreeable experience of getting into their mouths a small bug which is a little too highly flavored to suit the taste of the human race, but which is eaten by the crow blackbird in every month from February to October, inclusive. These bugs are not, however, consumed in large quantities, probably for the reason that great numbers can not be found; still, traces of them appear in many stomachs, indicating that the birds eat as many as they find.

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[1] Bull. Ill. State Lab. Nat. Hist., Vol. I, No. 3, Nov., 1880.

In addition to the insects specified, representatives of several other orders were found, but not in such large or regular quantities as to render them an important element of food. Hymenoptera are represented mostly by ants, while flies are entirely absent, being probably too lively to be taken by such sluggish birds. Spiders and myriapods (thousand-legs) were noted in sufficient numbers to demand recognition. They are eaten to some extent during every month, but not, as a rule, in large quantities. The spiders attain a maximum of more than 7 percent in May, and not only the spiders themselves, but their cocoons full of eggs appear to be taken whenever found. The myriapods are eaten somewhat less frequently, but appear in nearly every month.

Crustaceans, represented by crayfish, are very commonly eaten, though they do not constitute a large percentage of the food. It often happens that the only trace of these creatures found in a bird's stomach consists of the gastroliths, or 'stomach stones,' which are two saucer-shaped calcareous bodies found one on each side of the crayfish's stomach. One grackle, taken in Iowa, had no less than 26 of these stomach stones in its stomach. It seems hardly probable that this bird had eaten 13 crayfish at one meal or within a very short time, and it is possible that the gastroliths had been picked up on the banks of a pond or stream where the crustaceans had died and left their remains. In addition to crayfish, a few sowbugs (*Oniscus*) were found in some of the stomachs.

Snails of various species, both terrestrial and aquatic, with a few small bivalve mollusks, are also eaten by blackbirds, but, like the crustaceans, they form only a small percentage of the food. It might at first be supposed that these creatures were taken for the sake of the lime in their shells, as an aid in forming the eggshells of the blackbirds, but we find that they are eaten by both adult and young birds, by both sexes and at all seasons, which precludes the idea that the lime is used exclusively for this purpose. Earthworms were found in only a few stomachs, their *setæ* being noticed in a few others; but such soft and probably easily digested creatures are difficult to identify when they have been in the stomach a short time, and so may be easily overlooked.

The vertebrate food of the grackles consists of mice, birds and their eggs, lizards, snakes, frogs and salamanders (newts), and fish. So few remains of mice were found that these mammals can hardly be considered a legitimate article of the birds' diet. Birds and their eggs have been already discussed. Lizards' remains were found in a few stomachs taken in Florida, and the vertebræ of snakes were found occasionally, but not often. Frogs, tree toads, and salamanders are eaten, but not frequently, and do not appear to be a favorite food, or else are not easily taken. The same may be said of the fish whose bones appear now and then in the stomachs.

The vegetable component of the stomach contents is as variable and diversified as the animal food, showing plainly that when one article of diet is wanting the bird can make up the deficiency by eating something else that is more easily obtained. The following list includes all the vegetable substances identified in the stomachs, but there were some that could not be positively determined. The pulp of fruit, when unaccompanied by seeds and already half digested, is difficult to distinguish with precision, and this is also true of the hulls or skins left after kernels of grain have been digested and passed; but the total of such unrecognized matter is not great.

Vegetable substances found in stomachs of crow blackbirds.

Grain:
- Corn.
- Oats.
- Wheat.
- Rye.
- Buckwheat.

Fruit:
- Blackberries and raspberries.
- Strawberries.
- Cherries (cultivated).
- Mulberries.
- Currants.
- Grapes.
- Apples.
- Blueberries and cranberries (*Vaccinium* sp.).
- Huckleberries (*Gaylussacia* sp.).
- Dogwood berries (*Cornus* sp.).
- Elderberries (*Sambucus* sp.).
- Chokeberries (*Aronia arbutifolia*).
- Service berries (*Amelanchier canadensis*.)
- Hackberries (*Celtis occidentalis*).

Seeds and nuts:
- Poison ivy (*Rhus radicans*).
- Harmless sumac (*Rhus glabra et al.*).
- Bayberries (*Myrica cerifera*).
- Hornbeam (*Ostrya virginiana*).
- Chestnuts and chinquapins (*Castanea dentata* and *pumila*).
- Beechnuts (*Fagus atropunicea*).
- Acorns (*Quercus*).

Weeds:
- Ragweed (*Ambrosia*).
- Barngrass (*Chætocloa*).
- Gromwell (*Lithospermum*).
- Smartweed (*Polygonum*).
- Pokeweed (*Phytolacca*).
- Sorrel (*Rumex*).

Miscellaneous:
- Small bulbs or tubers.
- Galls containing larvæ.
- Pieces of plant stems.
- Bits of grass and leaves.
- Thorn of locust (*Robinia*).
- Pieces of rotton wood.

Of all the various items of food, the chief interest centers about the grain and fruit, for it is through their consumption that blackbirds inflict the greatest damage upon the farmer; in fact, the worst that has been said of the grackles is that they eat large quantities of grain. Of the five grains named in the list corn is the favorite, having been found in 1,321 stomachs, or more than 56 percent of the whole number. It is eaten at all seasons of the year; and in every month except January, July, August, and November amounts to more than one-half of the total vegetable food. The corn obtained in winter and until planting in the spring can be but little loss to the farmer, as it must be mostly waste grain. This view was fully confirmed by the contents of a series of stomachs taken in early spring, which consisted to a great extent of corn that had evidently been wet and frozen, and had lain out all winter. After February there is a decrease in the quantity of corn eaten until July, when it reaches a minimum of 7.7 percent. May shows no increase over the preceding months, although it is the time for planting; nor is there an important increase in June, the month of sprouting corn in the North. In fact, very little evidence was found to indicate that blackbirds pull up sprouting grain. In this respect they differ conspicuously from the crow. In August corn amounts to one-seventh of the whole food, and this, together with a part of that taken in September, is green corn 'in the milk.' The maximum amount, 82 percent, is eaten in February, but this, as already stated, is chiefly waste. In September and October, on the other hand, when corn constitutes 53.2 and 51.5 percent, respectively, of the food totals, it is undoubtedly all taken from the fields of standing corn, representing so much good grain contributed by the farmer; and in the Middle and Western States, where grain often stands in the fields until December, the November corn food must be obtained in the same way.

Oats, which are eaten in very irregular quantities in every month except January, November, and December, form much less of the food than corn. They appear in the greatest amount in April (a little more than one-seventh of the total food), fall to less than 1 percent in June, but rise to more than 9 percent in August. The oats eaten in April are probably picked up from newly sown fields, and it is likely that those taken in August and September are gleaned from fields after harvest, while those found in the other months are accidental and of no importance.

Wheat is eaten in every month from April to September, inclusive, but makes very little showing except in July and August, when it forms 26 percent of the whole food, these being the only months of the year in which it reaches a higher percentage than corn. As July and August are the months of the wheat harvest, it is easy to account for the large amount eaten at that time; but whether the grain so eaten is taken from the standing crop, or consists merely of scattered kernels gleaned after the harvest, is not manifest from stomach examination. Probably the birds take whichever is more accessible.

Rye was found in only one stomach and buckwheat in nine. The former was from a bird taken in May in Pennsylvania, and is evidently not a favorite food. Three birds taken in New Jersey in February were found to have eaten a small quantity of buckwheat. A single bird killed in July in New York and one killed in September in Iowa had also eaten this grain, as had four birds that were all taken at once in November in New Jersey. The buckwheat eaten in February and November must have been waste grain, and the fact that birds from the same localities, taken at the time when this grain was harvested, had not eaten it, indicates that it is not a desirable food and is eaten only under stress of hunger.

According to reports from the Southern States, crow blackbirds prey upon rice in company with other blackbirds and the bobolink, but unfortunately the collection contains few stomachs from this region, so that no corroborative evidence is at hand.

Although fruit of some kind is eaten in every month from March to December, inclusive, it does not become important until June. In June, July, and August it reaches 7, 13, and 10 percent, respectively. This aggregate is made up from a number of elements (see p. 64), but the only ones likely to possess any economic interest are blackberries, raspberries, cherries, currants, grapes, and apples. Apple pulp was found in 3 stomachs, grapes in 3, currants in 1, cherries in 37 in June and 14 in July, and strawberries in 7. The blackberries and raspberries were the favorites, and made up the great bulk of the fruit eaten. They were eaten from May to September, inclusive, but only a few in each month, except in July and August, when they were found in 96 and 68 stomachs, respectively. When we consider that the latter fruits are much more abundant in the wild than in the cultivated state, and bear in mind the small amount of other fruit eaten, it certainly must appear that the damage to fruit by crow blackbirds is of no great moment. None of the wild fruits mentioned in the table were found in large quantities or in many stomachs.

Mast, under which term are included chestnuts, chinquapins, acorns, and beechnuts, forms quite an important element in the fall and early spring months. It constitutes the principal part of the vegetable food of the 7 stomachs taken in January and does not appear in the 8 February stomachs to an important extent; but this record, based on only 15 stomachs, can not be considered very reliable. It composes about 10 percent of the March food, but decreases through the ensuing months till September, when it again becomes an important element and so continues through the rest of the year.

Weed seeds form another interesting element of vegetable food and are of considerable importance in the colder months. Beginning in February, they constitute more than 7 percent of the food, increase slightly in March, and then gradually diminish until they almost disappear in June, but again increase to a maximum of more than 11 percent in October. As all the plants included in this category are nuisances, it is, perhaps, needless to say that by eating their seeds the birds are doing good work.

The mineral component of the stomach contents possesses little, if any, economic interest, but it is curious to note how many different things a blackbird can pick up. Sand, gravel, pieces of brick, bits of mortar, plaster of paris, charcoal, hard coal, and cinders were the most common of the various hard substances which helped to line the mill in which their grist was ground. A glass bead was found in one stomach. Much of the gravel from stomachs of birds taken in

Kansas was found to contain fossil remains of corals, crinoid stems, shells, etc.

As previously stated, 456 nestlings are included in the 2,346 birds whose food has been already discussed. A separate study was made of these, in order to ascertain in what respect, if any, their food differed from that of the adults. It would have given more satisfactory results if it had been possible to separate the younger nestlings—say those under 1 week of age—from the older ones, for it was noticed that as the young approach maturity and get ready to fly, their food becomes more like that of their parents. The young were collected from May 22 to June 30, inclusive, and represent every age, from the newly hatched to those about to leave the nest. The whole food, when separated into its two principal components, was found to be as follows: Animal matter, 74.4 percent; vegetable, 25.6 percent. The much higher percentage of animal food in the young as compared with the adults (30.3 percent) is at once noticeable, although it may be insisted that the food of the young should be compared with that of the adults in the corresponding season; that is, in the months of May and June. If this view be taken, the difference is not so great. The percentage of mineral matter in the stomachs is also a little greater than in the case of adults.

The animal food is practically the same as that of the parent birds, and likewise consists chiefly of insects. These amount to 70 percent, 43 percent more than in the adults. The animal food other than insects, amounting to less than 5 percent, is not important enough to merit attention. The insect food is made up of about the same kinds as are eaten by the old birds, but in somewhat different proportions. Adult beetles, on account of their hard shells, are not fed to very young birds, but a few are given to the older ones. Grubworms (the larvæ of scarabæids) are fed freely after the first or second day. A little more than 19 percent of the food of the nestlings consists of this family of beetles, and for the most part in the form of the larvæ or grubs. Predaceous beetles (carabids) constitute about 10 percent of the food, weevils a little more than 3 percent, and there were traces of five or six other families, none of which reached 1 percent.

Grasshoppers and crickets, the former predominating, are a favorite food for the young, being softer and more easily digested than beetles. They constitute more than 21 percent of the total food. This is nearly as much as the parent birds consume in August, and three times as much as they eat in May and June, when they are feeding the young. This shows that they select the grasshoppers and other soft insects for their offspring, while they eat beetles and other hard things themselves.

Caterpillars constitute 6 percent of the food of the young birds, which is not as much as might be expected when we consider how soft and apparently well adapted they are for this purpose.

Besides the insects already mentioned, small quantities of ants, flies, bugs, May-flies, myriapods, and spiders were given to the young. These last merit a special notice from the fact that they form the earliest food of the bird. A number of tiny stomachs were examined, evidently taken from birds less than 24 hours old. In nearly every case they contained either a single spider or several very small ones—undoubtedly the bird's first meal. The very young stomachs are thin, almost membranous sacs, entirely unlike the stout, muscular gizzards of the adult birds, which explains why soft, easily crushed food is required for the newly hatched young. It is only after they have attained considerable growth and the stomach walls have become somewhat muscular that they are able to digest such food as hard beetles and corn.

The vegetable food of the young consists of corn and fruit, with mere traces of half a dozen other things. Corn amounts to 15 percent of the total food, but is fed only to the older birds, whose stomachs have acquired the requisite muscular strength to digest it. Fruit constitutes about 7 percent of the food, almost exactly the same quantity as is consumed by the adults in the month of June, and consists of the same varieties.

SUMMARY.

From the foregoing results it appears that the food of the crow blackbird for the whole year consists of animal and vegetable matter in quite unequal proportions. Of the animal component, nine-tenths are insects, and of the insects two-thirds are noxious species. The charge that the blackbird is a habitual robber of other birds' nests seems to be disproved by the stomach examinations.

Of the vegetable food it has been found that corn constitutes more than half and other grain less than one-seventh. Oats are seldom eaten except in April and August, and wheat is taken chiefly in July and August. Fruit is eaten in such moderate quantities that it has no economic importance, particularly in view of the fact that so little belongs to cultivated varieties.[1]

The farmer whose grain is damaged, if not wholly ruined, by these birds, may attempt to count his loss in dollars and cents, but the good services rendered by the same birds earlier in the season can not be estimated with sufficient precision for entry on the credit side of the ledger. And although the number of useful predaceous beetles they destroy is rather large, yet it must be considered that the final value of useful birds depends not so much on the character of the insects they destroy as on the extent of their work in keeping the great tide of insect life down to a proper level. The examination of the food of the blackbirds has shown that they do a good share of this work, and are therefore most emphatically useful birds—so useful that no general war of extermination should be waged against them. This does not mean that they do no harm, or that they should be permitted to do harm without restraint. A bird whose diet contains 46.5 percent of grain must be capable of considerable damage in any section of country where grain is an important crop; and when blackbirds descend upon a corn or wheat field in flocks of hundreds or thousands, they inflict a real loss, from which the farmer should protect himself by any practicable means. Still, crow blackbirds have not been complained of so much as redwings, and they probably do not ordinarily cause much loss to the farmer, since such a large part of the grain they eat consists of scattered or waste kernels. The local ravages they commit are usually due to overcrowding in a restricted area, and when this occurs there is no doubt that their numbers should be reduced.

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[1] In the appended table blackberries, raspberries, and other fruits of the genus *Rubus* are classed as cultivated fruit, since it is impossible to distinguish the wild from the cultivated in stomach examinations; but probably by far the greater part comes from wild plants.

The following table shows the percentage of each article of diet for each month:

Food of the crow blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 7; February, 8; March, 53; April, 289; May, 348; June, 887; July, 346; August, 197; September, 81; October, 111; November, 11; December, 8. Total, 2,346.]

Food.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Pred. beetles	7.1	0.3	4.3	6.3	8.5	12.9	11.1	9.1	3.1	2.6	1.5	0.5	5.6
May-beetle family	......	0.1	3.2	6.8	22.0	15.1	8.0	0.8	0.6	0.5	......	1.6	4.9
Snout-beetles	2.9	0.3	1.2	1.8	3.5	5.3	4.4	2.1	1.4	0.4	0.1	0.7	2.0
Other beetles	2.3	......	1.2	1.3	1.7	1.9	1.3	0.9	0.5	0.1	......	0.6	1.0
Caterpillars	4.3	0.3	1.2	2.3	8.2	3.6	1.2	0.7	1.3	1.3	......	3.1	2.3
Grasshoppers	......	0.6	0.8	1.2	8.8	14.6	12.7	23.4	8.1	6.9	9.0	1.9	7.3
Other insects	3.0	0.3	3.8	2.9	3.2	2.9	4.8	1.9	1.7	2.3	0.5	0.4	2.3
Spiders and myriapods	1.0	0.5	0.6	2.3	7.4	2.9	1.3	0.5	0.4	0.6	0.5	0.6	1.5
Crustaceans and mollusks	11.7	......	0.1	1.6	1.9	2.4	0.9	0.2	2.6	2.3	9.9	3.1	3.1
Vertebrates	......	......	1.2	0.3	0.7	0.5	0.2	0.1	0.6	[1]Tr.	......	......	0.3
Total animal food	32.3	2.4	17.6	26.8	65.9	62.1	45.9	39.7	20.3	17.0	21.5	12.5	30.3
VEGETABLE.													
Corn	1.4	82.0	58.4	40.9	27.2	28.2	7.7	14.0	53.2	51.5	35.4	47.3	37.2
Oats	......	1.2	0.9	14.5	2.2	0.4	5.2	9.3	1.1	0.8	......	......	2.9
Wheat	......	......	......	1.2	0.6	0.2	26.1	25.9	0.8	......	......	......	4.8
Other grain	......	6.7	......	0.6	0.3	......	0.2	......	[1]Tr.	0.8	10.5	......	1.6
Domestic fruit	......	......	0.4	......	[1]Tr.	5.8	10.3	9.1	1.3	0.4	......	8.2	2.9
Wild fruit	......	......	1.7	1.2	0.4	1.3	2.7	1.3	1.5	2.2	4.5	8.1	2.1
Weed seed	......	7.3	10.6	6.2	0.4	[1]Tr.	0.6	0.3	2.5	11.6	11.6	......	4.2
Mast, etc	66.3	0.4	10.4	8.6	3.0	2.0	1.3	0.4	19.4	15.7	16.5	23.9	14.0
Total vegetable food	67.7	97.6	82.4	73.2	34.1	37.9	54.1	60.3	79.8	83.0	78.5	87.5	69.7

[1] Tr. = trace.

The following is a list of the various insects identified in the stomachs of crow blackbirds:

Insects found in stomachs of crow blackbirds.

COLEOPTERA.

Cicindela punctulata.
Cicindela purpurea.
Cychrus sp.
Carabus sp.
Calosoma scrutator.
Calosoma calidum.
Calosoma externum.
Pasimachus depressus.
Scarites subterraneus.
Amara sp.
Chlænius sp.
Agonoderus pallipes.
Harpalus caliginosus.
Harpalus pennsylvanicus.
Helophorus inquinatus.
Olophrum convexum.
Scymnus sp.
Hister americanus.
Ips quadriguttatus.
Drasterius elegans.
Drasterius dorsalis.
Podabrus rugulosus.
Canthon sp.
Phanæus carnifex.
Onthophagus hecate.
Onthophagus pennsylvanicus.
Atænius sp.
Aphodius fimetarius.
Aphodius inquinatus.
Bolbocerus farctus.
Geotrupes sp.
Dichelonycha elongata.
Macrodactylus subspinosus.
Lachnosterna sp.
Anomala varians.
Ligyrus gibbosus.
Allorhina nitida.
Euphoria fulgida.
Euphoria inda.
Cremastochilus sp.
Prionus sp.
Strangalia sp.
Cryptocephalus venustus.
Typophorus canellus.
Colaspis brunnea.
Chrysomela pulchra.
Gastroidea polygoni.
Haltica sp.
Dibolia sp.
Coptocycla signifera.
Eleodes tricostata.
Epicærus imbricatus.
Phytonomus punctatus.
Sitones hispidulus.
Lixus sp.
Balaninus sp.
Sphenophorus zeæ, et al.
Calandra granaria.

LEPIDOPTERA.

Leucania unipuncta.
Deilephila lineata.

HEMIPTERA.

Euschistus sp.
Prionidus cristatus.

NEUROPTERA.

Corydalis cornutus.

THE BOAT-TAILED GRACKLE.

(*Quiscalus major.*)

The boat-tailed grackle, one of the largest of the blackbirds in the United States, inhabits the South Atlantic and Gulf States from Virginia to Texas, and is not found at any great distance from the coast.

Its food habits have received but brief consideration from ornithological writers. Audubon, whose account is apparently the best, says:

> The food of this species consists principally of those small crabs called "fiddlers," of which millions are found along the margins of the rivers and mud-flats, as well as of large insects of all kinds, ground-worms, and seeds, especially grains. * * * In autumn, while the rice is yet in the stack, they commit considerable mischief by feeding on the grain, although not so much as when it is in a juicy state, when the planters are obliged to employ persons to chase them from the fields.[1]

In the preliminary investigations made by the Biological Survey there have been examined 116 stomachs from Florida, Georgia, and Texas, representing every month in the year (see p. 76). The food consists of 39.8 percent of animal matter and 60.2 percent of vegetable matter. The former is made up of insects and crustaceans, with a few lizards, batrachians, small mammals, etc. Crustaceans amount to about two-fifths of the animal food (15.6 percent of the total food), and consist of crayfishes, crabs, and shrimps, which plainly indicate the littoral habits of the species. No insects appear to be specially sought. Predaceous beetles (Carabidæ) are eaten to the extent of 3.3 percent and are taken mostly in fall. Other beetles are eaten to some extent, but no family is conspicuous. Grasshoppers are eaten in July and August, to the extent of 31.9 and 47.7 percent, respectively, but very few in any other month. The average for the year is 7.3 percent. Various other insects form 9.7 percent of the food, but no order is especially prominent. Six birds taken in Texas in September are worthy of special mention from the fact that they had all eaten cotton-ball worms (*Heliothis armiger*) in quantities varying from 26 to 93 percent of the food. While remains of small vertebrates are frequent in the stomachs, they do not form an important element.

Grain constitutes 46.8 percent of the total food. Of this all but a mere trace is corn, which composes part of the food of every month except May—the only stomachs collected in this month came from a rice field at Savannah, Ga., where corn was probably not readily obtainable. In each month except May and November corn constitutes more than half of the vegetable food, and in March, April, and August it is the only vegetable matter taken. April shows the greatest amount (92.7 percent of the total food), but as only 3 stomachs were taken in this month, this result can hardly be regarded as a fair average. The pulp of some large seed or nut, not otherwise identified, was the most important element next to corn. The remains of figs were found in several stomachs and wild grapes in one, which indicates that fruit is eaten, though sparingly. No weed seed was found in any of the stomachs.

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[1] Ornith. Biog., Vol. II, p. 504, 1835.

SUMMARY.

In summing up the results of the stomach examinations it is evident that no very salient points in favor of the boat-tailed grackle have come to light. In its insect food it has no very pronounced preferences, and while it does not cause any great havoc among useful insects, it does not prey extensively upon harmful ones. In common with most other land birds, it eats grasshoppers freely in July and August, and it would probably eat caterpillars as well if it found them more plentiful than other food. The animal food it decidedly prefers is small crustaceans, and these, so far as the interests of agriculture are concerned, are entirely neutral.

In its vegetable diet, the bird certainly does not commend itself to the agriculturist. Its preference for corn is very marked and shows no variance with the change of season. That it visits the growing crop for its supplies is evident from the fact that much of the corn found in the stomachs during the early summer was 'in the milk.' In any locality, therefore, where this grackle is very abundant it must almost necessarily be harmful to the corn crop without rendering any well-defined service in return.

DISTRIBUTION OF STOMACHS.

Distribution of stomachs, by months and States.

BOBOLINK.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Connecticut	......	......	......	......	12	1	8	4	......	......	......	......	25
Dist. of Columbia	......	......	......	......	......	......	......	4	17	......	......	......	21
Georgia	......	......	......	......	2	......	......	......	7	......	......	......	9
Iowa	......	......	......	......	2	......	......	......	......	......	......	......	2
Kansas	......	......	......	......	4	......	......	......	......	......	......	......	4
Massachusetts	......	......	......	......	3	2	4	......	......	......	......	......	9
Michigan	......	......	......	......	2	......	......	......	......	......	......	......	2
Minnesota	......	......	......	......	2	4	1	3	......	......	......	......	10
Montana	......	......	......	......	......	......	......	9	......	......	......	......	9
New Jersey	......	......	......	......	......	......	......	10	......	......	......	......	10
New York	......	......	......	......	11	10	6	34	1	......	......	......	62
North Dakota	......	......	......	......	......	1	7	13	......	......	......	......	21
Pennsylvania	......	......	......	......	4	20	9	10	5	......	......	......	48
Rhode Island	......	......	......	......	......	......	3	......	......	......	......	......	3
South Carolina	......	......	......	......	......	......	......	......	2	......	......	......	2
South Dakota	......	......	......	......	......	......	2	......	......	......	......	......	2
Texas	......	......	......	......	3	......	......	......	......	......	......	......	3
Virginia	......	......	......	......	3	......	......	1	15	......	......	......	19
West Virginia	......	......	......	......	......	......	......	......	1	......	......	......	1
Wisconsin	......	......	......	......	3	3	2	7	2	......	......	......	17
Ontario, Canada	......	......	......	......	1	......	3	8	......	......	......	......	12
Total	......	......	......	......	52	41	45	103	50	......	......	......	291

Distribution of stomachs, by months and States—Continued.

COWBIRD.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Arizona					1	1							2
Connecticut				7	3				1				11
Dist. of Columbia											3		3
Georgia			4										4
Illinois			2	1	2								5
Iowa				6	4	1	3			1			15
Kansas			2	36	54	24	10	5	2				133
Kentucky										2			2
Maine								1					1
Maryland							1						1
Massachusetts				5	6		2						13
Michigan							1						1
Minnesota					5	3		1					9
New Jersey			1	5		1		6	7		2		22
New York				7	10	3	7	6	63	8			104
North Dakota							4	9					13
Ohio				4			2						6
Pennsylvania			6	6	9	15	22	6	1	5	1		71
Rhode Island							1		1				2
South Dakota					1		2						3
Tennessee											1		1
Texas	3	10	2	3		2	1	3	4	54	16	2	100
Virginia												9	9
West Virginia								1					1
Wisconsin			1	3	1	3	1						3
Canada					3								3
Total	3	10	18	83	99	53	57	38	79	70	23	11	544

YELLOW-HEADED BLACKBIRD.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
California					1								1
Iowa					1								1
Kansas				5	13								18
Michigan										3			3
Minnesota					11	10	9	28					58
Nebraska				1	1								2
North Dakota						4	3	24	4				35
South Dakota					1								1
Texas				3									3
Wisconsin							4	7					11
Wyoming								1	1				2
Northwest Territory, Canada					3								3
Total				9	31	14	16	60	5	3			138

Distribution of stomachs, by months and States—Continued.

RED-WINGED BLACKBIRD.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Arizona					8								8
California		1		2									3
Connecticut			3	5	6		6						20
Dist. of Columbia		2		1			2	4		4	4		17
Florida				2									2
Georgia					2								2
Illinois			5	3	2								10
Indiana							3						3
Iowa			5	5	2			1		40			53
Kansas			10	15	4	19	22						70
Maryland			1	2	3	54	11	22	2				95
Massachusetts	1			7	5	14	2						29
Michigan					1								1
Minnesota				2	12	5	13	21	2	2			57
Missouri			1										1
Nebraska				1	1			1					3
New Jersey			8	6	1						2		17
New York			2	9	14	12	8	7	2	4	1		59
North Dakota						2	6	42	1				51
Ohio				1									1
Pennsylvania			10	28	5	41	51	45	4	2			186
Rhode Island							1						1
South Carolina			1										1
South Dakota			3		2			2					7
Texas	10	45	34	11		8	11	1	31	29	70	81	331
Utah										2			2
Vermont										1			1
Virginia						1	5		8	5	5	1	25
West Virginia								2	4	1			7
Wisconsin			1	1	4	2			2				10
Wyoming								2					2
Ontario, Canada				3	3			1		1			8
Total	11	48	84	104	75	158	141	151	56	91	82	82	1,083

CALIFORNIA RED-WINGED BLACKBIRD.

California	2		3	2		13	1		2	18	13	7	61

RUSTY BLACKBIRD.

Connecticut			3	4						4			11
Dist. Columbia				1							4	1	6
Georgia			3										3
Illinois			1	6									7
Iowa				2	2					1			5
Kansas	1		5	20						5	5		36
Massachusetts			2	2	1					3			8
Minnesota				3					1	1			5
New Jersey											2		2
New York			1	4	4				2	8		1	20

Distribution of stomachs, by months and States—Continued.

RUSTY BLACKBIRD—Continued.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
North Dakota									1				1
Ohio										1			1
Pennsylvania				5							1		6
Texas		6									2	1	9
Virginia			1								1		2
West Virginia										1			1
Wisconsin				2									2
Nova Scotia								4					4
Ontario, Canada			1						1	1			3
Total	1	6	17	49	7			4	5	25	15	3	132

BREWER'S BLACKBIRD.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
California	7	1	4		1	10	9		7	14	10	6	69
Montana								12	13				25
North Dakota							1	8	18				27
South Dakota					6								6
Texas		6										9	15
Wyoming								4					4
Total	7	7	4		7	10	10	24	38	14	10	15	146

CROW BLACKBIRD.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Alabama											1		1
Connecticut			9	23	12	8	6			1			59
Dist. of Columbia			1	1	7	15	48	9		9	1		91
Florida			2	3				3		1		1	10
Illinois			2	7	8		9	3		4			33
Indiana				2	1		1						4
Iowa				10	4		1	2	12	10			39
Kansas			1	67	217	570	29		6	6			896
Kentucky					1					4			5
Louisiana					3								3
Maine				1						1			2
Maryland			1	28	3	210	159	152	3		2		558
Massachusetts				10									10
Michigan				6	2								8
Minnesota				2	3	6	2						13
Missouri				1									1
Nebraska				3					2	20			25
New Jersey		3	1	11	1		1		5		5		27
New York			7	17	17	11	1	1	29	9			92
North Dakota								6					6
Ohio				2		2	4	3	18				29
Pennsylvania			20	94	62	63	72	12	6	45	1		375
South Dakota				1						1			2
Tennessee					2							1	3
Texas	7	5	4		2	2						6	26
Virginia			2				11	3					16

Distribution of stomachs, by months and States—Continued.

CROW BLACKBIRD—Continued.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
West Virginia								3					3
Wisconsin					3								3
Ontario, Canada			3				2				1		6
Total	7	8	53	289	348	887	346	197	81	111	11	8	2,346

BOAT-TAILED GRACKLE.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Florida	1							2	1	1			5
Georgia					8								8
Texas	23	20	3	3		12	14	2	8	4	5	9	103
Total	24	20	3	3	8	12	14	4	9	5	5	9	116

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